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December 23, 2003

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Fellow Federal Facility Agreement (FFA) Representatives:

SUBJECT: DRAFT FINAL TECHNICAL MEMORANDUM, SUMMARY REPORT, APHO 46 AND MSC R2, FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

Submitted for your review is the *Draft Final Technical Memorandum, Summary Report, APHO 46 and MSC R2, Former Marine Corps Air Station El Toro, California*. This Technical Memorandum presents the results of an investigation of Aerial Photograph Anomaly (APHO) 46 and Miscellaneous Refuse Area 2 (MSC R2) at the former Marine Corps Air Station (MCAS), El Toro, California. The investigation of these two areas was conducted as part of the pre-design investigation of Installation Restoration Program (IRP) Sites 3 and 5 and was completed in accordance with the *Final Work Plan, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* (July 2002) and *Final Sampling and Analysis Plan, Amendment Number 1, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* (October 2003).

Soil sampling was conducted at APHO 46 in August 2002 in accordance with the sampling design proposed in the Pre-Design Investigation Work Plan (July 2002). The analytical results obtained during the soil investigation along with risk screening results were presented in the *Draft Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California* (January 2003), and were submitted to the U.S. Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), and California Regional Water Quality Control Board, Santa Ana Region (CRWQCB), for review. Following comments by the DTSC (dated 13 February 2003), EPA (25 February 2003), and CRWQCB (1 May 2003), and discussions during our meetings on 28 May and 16 June, 2003, regarding the detection of dioxins and furans in all soil samples collected at the site, the Navy agreed to conduct an additional investigation to complete the characterization of APHO 46. The enclosed Draft Final Technical Memorandum incorporates the results of the additional investigation conducted at APHO 46 in September 2003 to address the comments of our fellow FFA Representatives.

We believe that based on the additional data found in the report that concludes that APHO 46 has been characterized adequately and represents a risk to human health that is well within the EPA-established risk management decision range of 10^{-6} to 10^{-4}, the regulatory agencies will concur with the Navy recommendation for no further investigation pending the results of the radiological assessment. We also believe that based on the conclusion that there is no evidence of waste placement or landfill activities at MSC R2, the agencies will concur with the no further investigation recommendation at this site.

The enclosed Draft Final Technical Memorandum is a supporting document that will advance the Site 3 and 5 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. We anticipate that your review of and concurrence with this document should proceed efficiently given the detail of prior discussions regarding sampling at APHO 46. Please provide any comments or your concurrence by **Friday, January 30, 2004**.

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Thank you for your continued support in this program. Should you have questions or need additional information, please contact Mr. Karnig Ohannessian, Remedial Project Manager, at (619) 532-0796 or me at (619) 532-0784.

Sincerely,

F. ANDREW PISZKIN
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

Enclosure: 1. Draft Final Technical Memorandum, Summary Report, APHO 46 and MSC R2, Former MCAS El Toro, California – Dated December 2003

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Technical Memorandum Summary Report APHO 46 and MSC R2

FORMER MARINE CORPS AIR STATION, EL TORO, CALIFORNIA

December 2003

Department of the Navy
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Naval Facilities Engineering Command
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NAVFAC
Naval Facilities Engineering Command
SOUTHWEST DIVISION

Draft Final

Technical Memorandum Summary Report APHO 46 and MSC R2

FORMER MARINE CORPS AIR STATION, EL TORO, CALIFORNIA

December 2003

Prepared for:

Naval Facilities Engineering Command
SOUTHWEST DIVISION

Department of the Navy
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ACRONYMS AND ABBREVIATIONS

μg/kg	microgram per kilogram
APCL	Applied Physics and Chemistry Laboratory
APHO	aerial photograph anomaly
bgs	below ground surface
BCT	BRAC Cleanup Team
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
CRWQCB	California Regional Water Quality Control Board, Santa Ana Region
CTO	Contract Task Order
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DON	Department of the Navy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EM	electromagnetic induction
EPA	Environmental Protection Agency, United States
EPC	exposure point concentration
GPR	ground-penetrating radar
HI	hazard index
ID	Identification
JEG	Jacobs Engineering Group
MCAS	Marine Corps Air Station
mg/kg	milligram per kilogram
MSC R2	Miscellaneous Refuse Area 2
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NAVFAC EFD PACIFIC	Pacific Division, Naval Facilities Engineering Command
NAVFAC EFD SOUTHWEST	Southwest Division, Naval Facilities Engineering Command
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pg/g	picogram per gram
PHC	petroleum hydrocarbons
PRG	preliminary remediation goal
RME	reasonable maximum exposure
ROD	record of decision
SAIC	Science Applications International Corporation
SVOC	Semivolatile organic compound
TCDD	tetrachlorodibenzodioxin
TEF	toxicity equivalency factor
TEQ	toxicity equivalence
TPH	total petroleum hydrocarbons
UCL	upper confidence limit
U.S.	United States
VOC	volatile organic compound

1. INTRODUCTION

This technical memorandum presents the results of an investigation of Aerial Photograph Anomaly (APHO) 46 and the possible landfill area designated as Miscellaneous Refuse Area 2 (MSC R2) at the former Marine Corps Air Station (MCAS), El Toro, California. The investigation of these two areas was conducted as part of the pre-design investigation of Installation Restoration Program (IRP) Sites 3 & 5 and was completed in accordance with the *Final Work Plan, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2002) and *Final Sampling and Analysis Plan, Amendment Number 1, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2003a).

This technical memorandum was prepared for Southwest Division, Naval Facilities Engineering Command (NAVFAC EFD SOUTHWEST; formerly abbreviated as SWDIV), as authorized by the Pacific Division, Naval Facilities Engineering Command (NAVFAC EFD PACIFIC) under Contract Task Order number 0078 of the Comprehensive Long-Term Environmental Action Navy II program, contract number N62742-94-D-0048. It complies with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) in Title 40 of the Code of Federal Regulations, Part 300.

1.1 MCAS EL TORO BACKGROUND

Former MCAS El Toro is located in south-central Orange County, California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). Former MCAS El Toro covers approximately 4,738 acres. Land use around former MCAS El Toro includes commercial, light industrial, agricultural, and residential. Former MCAS El Toro closed on 2 July 1999, as a part of the Base Realignment and Closure (BRAC) Act.

1.2 APHO 46 DESCRIPTION

APHO 46 is located in the eastern portion of MCAS El Toro and constitutes an open unpaved area adjacent to IRP Site 5 and northeast of golf course (see Figures 1-1 and 1-2). APHO 46 was identified during a review of historical aerial photographs conducted by Science Applications International Corporation in 1993 (SAIC 1993). In the aerial photograph dated 4 February 1979, APHO 46 appears to be a large impoundment and fill area. It was observed that, during 1979, the northwestern portion of APHO 46 appeared to be a fill area with facilities under construction. Excavations that form two impoundments surrounded by berms occupied the remainder of the site. Two open trenches in the southwestern area of the site were also identified in the photograph and were made part of Site 5.

1.2.1 APHO 46 History

1.2.1.1 GEOPHYSICAL SURVEY AND VISUAL INSPECTION OF APHO 46 VICINITY

A geophysical survey was conducted at APHO 46 by Geovision during April and May 2000 (Geovision 2000). The survey area was larger than the APHO 46 investigation area and encompassed approximately 12 acres, including the southwestern portion of Site 5. This survey detected an anomaly that was identified as a trench in the southwestern portion of Site 5; otherwise no other subsurface anomalies or trench features were identified. Additionally, the survey revealed the presence of a small area near the center of APHO 46 containing scattered, surface and near surface metallic and/or construction debris (see Figure 1-2). The Department of the Navy (DON) carried out a visual inspection of APHO 46 vicinity in June and September 2000, during which the survey team observed construction debris including metallic debris and pieces of asphalt and glass on the ground surface.

The findings of the geophysical survey were presented in the *Summary Report for Aerial Photograph Anomaly 46, Aerial Photograph Anomaly Program, MCAS El Toro* (DON 2000). DON recommended in this report that the construction debris observed on the ground surface within the APHO 46 investigation area be managed during the implementation of the final remedy for Site 5 and a "no further action" status be assigned for APHO 46 in the next business plan update.

The summary report was submitted to California Department of Toxic Substances Control (DTSC); California Regional Water Quality Control Board, Santa Ana Region (CRWQCB); and United States (US) Environmental Protection Agency (EPA) for review. The DTSC, in a letter dated 26 February 2001, stated the following: "DTSC does not concur with the recommendation of no further action to APHO 46 until the proposed management of APHO 46 with remedial activities for Site 5 are properly documented in the Draft Final Record of Decision (ROD) for Sites 3 and 5." In a letter dated 30 October 2000, CRWQCB stated that due to the presence of an area of indiscriminate surface debris, additional investigation was recommended and that the near surface debris should be removed. Therefore, to investigate and manage the surficial debris at APHO 46, this area was included in the pre-design investigation activities at Site 5.

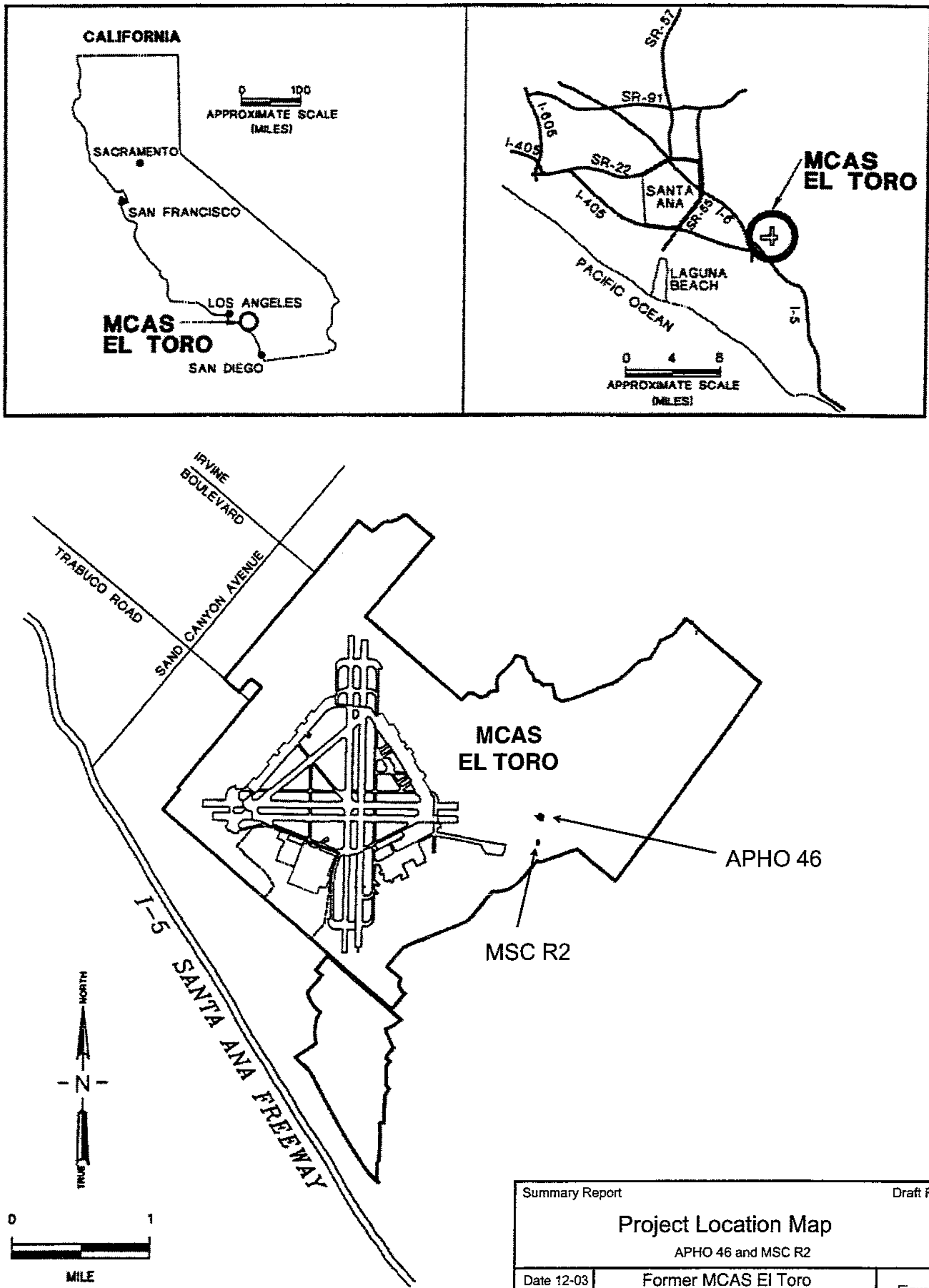
1.2.1.2 SOIL SAMPLING

Two soil sampling events have been conducted at APHO 46 to assess the potential impacts and releases resulting from disposal activities that created the surface or near-surface debris pile within APHO 46. For the purpose of this report, they are referred to as Phase I and Phase II soil sampling events.

Phase I soil sampling at APHO 46 was conducted in accordance with the Final Work Plan (Earth Tech 2002). The main objective of this soil sampling was to assess whether there are releases associated with the disposal that created the surface and near-surface debris pile within APHO 46.

Eleven soil samples were collected for chemical analysis from six locations within APHO 46 during the Phase I soil sampling. The results of the Phase I soil sampling were presented in the *Draft Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2003b). This report recommended no further investigation at APHO 46 based on the following results:

- Analytical data from the soil samples indicated no significant contamination at APHO 46. Low concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), petroleum hydrocarbons, organochlorine pesticides, polychlorinated biphenyls (PCBs), metals, and dioxins (the term dioxins refer to all the analyzed dioxin/furan congeners) were detected in soil samples; however, only arsenic and dioxins (expressed as equipotent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin [2,3,7,8-TCDD]) exceeded their respective residential preliminary remediation goals (PRGs) (EPA Region 9 2002).
- A conservative risk screening based on the maximum detected concentrations of the contaminants at APHO 46 indicated a risk ratio of 3.8, which is equivalent to a cancer risk of 3.8E–06. This cancer risk is well within the 10^{-6} to 10^{-4} cancer risk range established by the NCP.
- With the exception of dioxins, all other analytes were deemed not to pose a potential risk to human health and the environment.



Summary Report | Draft Final

Project Location Map

APHO 46 and MSC R2

Date 12-03	Former MCAS El Toro	Figure 1-1
Project No 37380	EARTH TECH A tyco INTERNATIONAL LTD. COMPANY	

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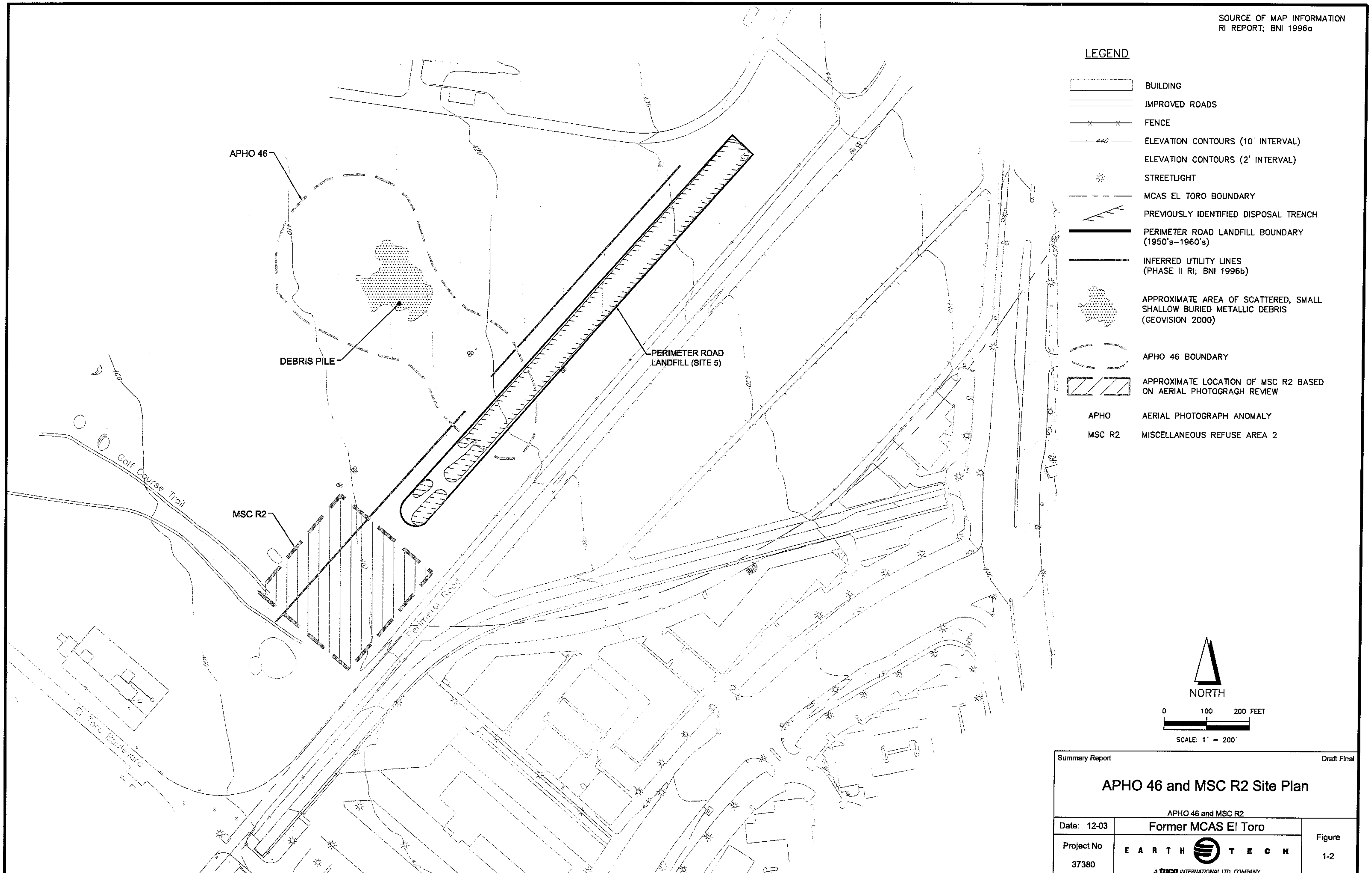

Summary Report

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APHO 46 and MSC R2 Site Plan

APHO 46 and MSC R2

Former MCAS El Toro

Date: 12-03	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	Figure 1-2
Project No 37380		

File: L:\work\Remediation\Projects\37380 (CTO-78)\APHO 46\CAD\Figure 1-2.dwg Time: Dec 23 2003 - 1:21pm

This report was submitted to the EPA, DTSC, and the CRWQCB for review. CRWQCB did not have any comments on the report. DTSC and EPA comments on this report were received on 13 February 2003 and 25 February 2003, respectively. Both agencies recommended additional sampling for dioxins at APHO 46 to assess their horizontal and vertical extent since all 11 samples showed detections of dioxins (responses to comments received from DTSC and EPA are provided in Appendix A). This issue was discussed in detail during meetings with the BRAC Cleanup Team (BCT) on 28 May and 16 June 2003, and DON agreed to conduct an additional investigation to complete the characterization of APHO 46.

In consultation with the BCT, DON agreed to collect three random surface soil samples outside of the debris pile area but within the site boundary, as well as at one vertical sampling location to 10 feet below ground surface (bgs) at the location of the highest detected dioxin concentration within the debris pile area. The data quality objectives (DQOs), procedures for field investigation activities, and quality control/quality assurance (QA/QC) requirements for additional soil sampling were presented in the *Final Sampling and Analysis Plan, Amendment Number 1, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2003a). Seven soil samples were collected for dioxin analysis from four locations within APHO 46 during the Phase II soil sampling activities. The soil sampling activities are summarized in Section 2.1.1.

1.2.1.3 Radiological Assessment

Radiological assessment of APHO 46 began with stationwide historical radiological assessment (HRA) for MCAS El Toro (Weston 2000). As a part of HRA, historical records were reviewed, site inspections were performed, and interviews and limited informal surveys were conducted at MCAS El Toro. Based on the survey results, Site 5 including APHO 46 was recommended for further investigation, including radiological surveys. The radiological surveys using scan and stationary survey techniques, and soil sampling for radiological characterization of APHO 46 were performed in November and December 2001, respectively. The results of these investigations will be presented in the Draft Radiological Release Report for MCAS El Toro.

1.3 MSC R2 Description and History

The *MCAS El Toro Final Environmental Baseline Survey Report* (JEG 1995) reported the presence of a former refuse area as a possible landfill area and designated it as MSC R2. Its location was identified as an area at the southwestern end of Site 5, northwest of El Toro Boulevard (also known as Trabuco Road). Figure 1-2 shows the general location of MSC R2.

MSC R2 was identified based on personnel interviews conducted as a part of the Environmental Baseline Survey. The *MCAS El Toro Final Environmental Baseline Survey Report* (JEG 1995) states the following:

> *"According to the interview panel, landfilling activities occurred in an area located south of the current boundaries defined for the Perimeter Road Landfill. This newly identified landfill area extended from the currently defined southern tip of Perimeter Road Landfill south to include the Station Golf Course's fifth hole tee box and fourth hole green. Access to this area was via an unpaved road that led from about the intersections of El Toro Road and Perimeter Road. Landfilled material consisted of general construction debris. Hazardous substances are believed not to have been disposed of into this fill area".*

Reviews of aerial photographs taken from 1946 through 1991 do not indicate any activity that would suggest waste placement. The golf course was confined to the southwest of El Toro Boulevard in the

1952 photograph. The 1961 photograph shows the fifth tee hole to extend beyond El Toro Boulevard to the golf course trail. Based on this review, the extent of MSC R2 was revised to encompass the area between the southwestern boundary of Site 5 and the golf course trail.

2. FIELD INVESTIGATION ACTIVITIES

2.1 APHO 46

Two soil sampling events have been conducted at APHO 46 to assess the potential impacts and releases resulting from disposal activities that created the surface or near-surface debris pile within APHO 46. For the purpose of this report, they are referred to as Phase I and Phase II soil sampling events.

2.1.1 Soil Sampling Activities

2.1.1.1 *Phase I Soil Sampling*

Eleven soil samples (including one duplicate) were collected from six locations within APHO 46 and analyzed for VOCs, SVOCs, polynuclear aromatic hydrocarbons (PAHs), petroleum hydrocarbons (as gasoline, diesel, and motor oils), organochlorine pesticides, PCBs, chlorinated herbicides, metals, and dioxins during Phase I soil sampling (Figure 2-1). VOCs, SVOCs, PAHs, petroleum hydrocarbons, organochlorine pesticides, PCBs, chlorinated herbicides, metals (excluding mercury), mercury, and dioxins were analyzed by EPA methods, 8260B, 8270C, 8270-SIM, 8015B, 8081A, 8082A, 8151A, 6010B, 7471A, and 8290C, respectively.

All samples were collected in accordance with CLEAN Standard Operating Procedure 4, *Soil Sampling* (BNI 1999a) on 27 August 2002, using unused, disposable trowels. Subsurface samples (1 and 2 feet bgs) were collected at three locations with the aid of a backhoe. One duplicate sample was collected at location APHO46-SS01 at a depth of 2.0 feet bgs.

One of the six sampling locations, 05-APHO46-SS01, was purposely placed adjacent to a scrap metal and concrete debris pile to assess whether waste within the scrap pile has impacted adjacent soil. The other five sampling locations were determined randomly to equally distribute the sample locations throughout the area. Asphalt-like material was encountered at each of the subsurface sampling locations. Table 2-1 presents a summary of the information associated with the soil samples collected at APHO 46 during Phase I soil sampling.

Table 2-1: Summary of Soil Samples Collected at APHO 46 during Phase I Soil Sampling

EPA ID	Earth Tech Sample ID	Location	Depth (bgs)	Sampling Rationale
Phase I Soil Sampling				
LI 001	05-APHO46-SS01-S01-S-0.5	05-APHO46-SS01	0.5 feet	Judgmental (Debris Pile)
LI 002	05-APHO46-SS02-S01-S-0.5	05-APHO46-SS02	0.5 feet	Random
LI 003	05-APHO46-SS03-S01-S-0.5	05-APHO46-SS03	0.5 feet	Random
LI 004	05-APHO46-SS04-S01-S-0.5	05-APHO46-SS04	0.5 feet	Random
LI 005	05-APHO46-SS05-S01-S-0.5	05-APHO46-SS05	0.5 feet	Random
LI 006	05-APHO46-SS06-S01-S-0.5	05-APHO46-SS06	0.5 feet	Random
LI 007	05-APHO46-SS01-S02-S-1.0	05-APHO46-SS01	1.0 feet	Judgmental (Debris Pile)
LI 008	05-APHO46-SS01-S03-S-2.0	05-APHO46-SS01	2.0 feet	Judgmental (Debris Pile)
LI 009	05-APHO46-SS01-S04-D-2.0	05-APHO46-SS01	2.0 feet (duplicate)	Judgmental (Debris Pile)
LI 010	05-APHO46-SS02-S02-S-2.0	05-APHO46-SS02	2.0 feet	Random
LI 011	05-APHO46-SS06-S02-S-2.0	05-APHO46-SS06	2.0 feet	Random

Notes:
bgs = below ground surface
EPA = Environmental Protection Agency
ID = Identification

2.1.1.2 *Phase II Soil Sampling*

Seven soil samples (including one duplicate) were collected from four locations during Phase II soil sampling and analyzed for dioxins by EPA Method 8290C (Figure 2-1). All samples were collected in accordance with CLEAN Standard Operating Procedure 4, *Soil Sampling* (BNI 1999a). The three surface soil samples outside of the debris pile area but within the APHO 46 boundary were collected from three randomly selected locations on 12 September 2003, using unused, disposable trowels. The soil samples at the location of the highest detected dioxin concentration within the debris pile area were collected on 22 September 2003, using a backhoe. One duplicate was collected, at location APHO46-SS07, at a depth of 0.5 feet bgs.

In order to complete the vertical characterization of the site, three judgmental samples were collected at the Phase I sampling location 05-APHO46-SS01 (location with highest detected dioxin concentrations during Phase I sampling) at depths of 2.5 feet, 5 feet, and 10 feet bgs (Figure 2-1). The other three sampling locations were distributed randomly outside of the debris pile area but within the site boundary to complete the characterization of the site. Asphalt-like material was encountered at each of the subsurface sampling locations. Table 2-2 presents a summary of the information associated with the soil samples collected at APHO 46 during the Phase II soil sampling.

Table 2-2: Summary of Soil Samples Collected at APHO 46 during Phase II Soil Sampling

EPA ID	Earth Tech Sample ID	Location	Depth (bgs)	Sampling Rationale
LI056	05-APHO46-SS08-S01-S-0.5	05-APHO46-SS08	0.5 feet	Random
LI057	05-APHO46-SS09-S01-S-0.5	05-APHO46-SS09	0.5 feet	Random
LI055	05-APHO46-SS07-S01-S-0.5	05-APHO46-SS07	0.5 feet	Random
LI058	05-APHO46-SS07-S02-D-0.5	05-APHO46-SS07	0.5 feet (duplicate)	Random
LI059	05-APHO46-SS01-S05-S-2.5	05-APHO46-SS01	2.5 feet	Judgmental (Debris Pile)
LI060	05-APHO46-SS01-S06-S-5.0	05-APHO46-SS01	5.0 feet	Judgmental (Debris Pile)
LI061	05-APHO46-SS01-S07-S-10.0	05-APHO46-SS01	10.0 feet	Judgmental (Debris Pile)

Notes:
bgs = below ground surface
EPA = Environmental Protection Agency
ID = Identification

2.1.2 Sample Analysis and Validation

The eleven samples collected during the Phase I soil sampling were submitted to Applied Physics and Chemistry Laboratory (APCL) of Chino, California, under chain of custody for analysis of the following analytical groups in accordance with the Final Work Plan (Earth Tech 2002): VOCs, SVOCs, PAHs, petroleum hydrocarbons (as gasoline, diesel, and motor oils), PCBs, organochlorine pesticides, chlorinated herbicides, metals, and dioxins. The seven samples collected during the Phase II soil sampling were submitted to APCL under chain of custody for analysis of dioxins and furans in accordance with the Final Sampling and Analysis Plan, Amendment Number 1 (Earth Tech 2003a). The samples were collected using pre-cleaned disposable trowels and backhoe, and placed into 16-ounce glass jars (except for samples to be analyzed for volatile analytes, which were collected using Encore sampling devices). Samples were refrigerated upon collection and transported to the laboratory. The primary laboratory, APCL, is certified by the California State Environmental Laboratory Accreditation Program (Certificate #1431). Paradigm Analytics of Wilmington, North Carolina performed the analysis for dioxins.

A data quality assessment consisting of a review of analytical methods; reporting limits; laboratory, field, and method blanks, and QA/QC procedures was conducted.

Laboratory data were validated by Laboratory Data Consultants of Carlsbad, California, in accordance with:

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1999) and
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2002a).

Laboratory data were validated as specified in the U.S. Navy Engineering Command, Southwest Division, Environmental Work Instruction EW#1. Level D validation was performed on 20 percent or more of the samples, with the balance validated at Level C.

The data validation findings are summarized, indicating the findings of the review process. Data are reported flagged with appropriate qualifiers to indicate their usability.

Data may be assigned the following qualifiers:

J	estimated concentration
U	not detected (including not present because of blank contamination)
R	rejected data (unusable)

Combinations of qualifiers such as UJ are possible.

Some individual results were reported twice (because of method-required dilutions or duplication between methods). The results were evaluated and the highest concentration (or lowest detection limit) was used.

The data were found usable for the purposes intended, except as discussed below:

- Methylene chloride was reported in laboratory blanks, resulting in some data being flagged as UJ with elevated detection limits.
- Antimony, silver, and selenium were reported in selected method blanks, resulting in some data being flagged as UJ with elevated detection limits.

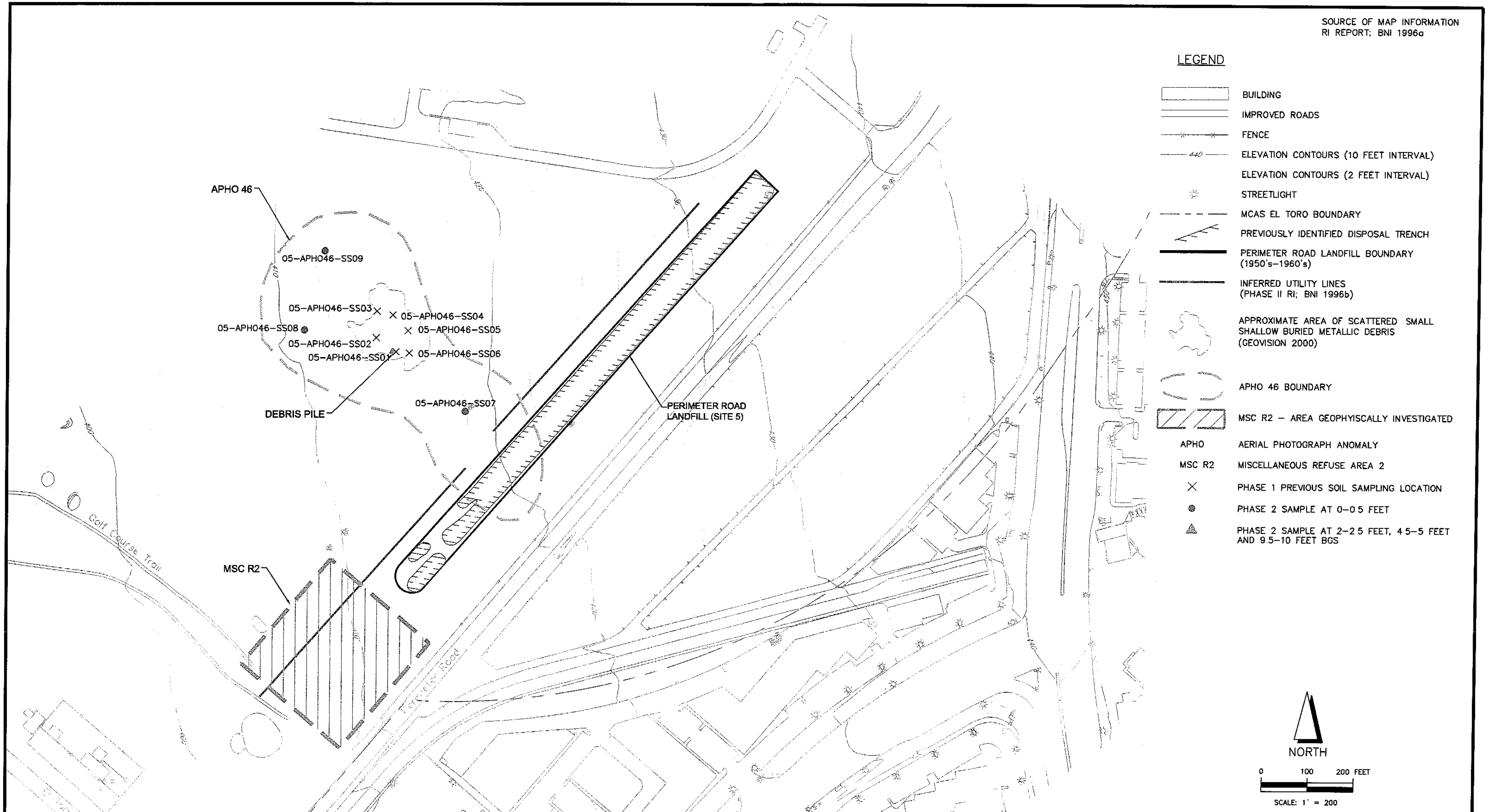
2.1.3 Location Survey

All nine sampling locations were subsequently surveyed by a California-licensed land surveyor.

2.2 GEOPHYSICAL INVESTIGATION AT MSC R2

A geophysical investigation was conducted at MSC R2 on 10 and 11 September 2002. Approximately half of the area investigated had been geophysically investigated by a previous contractor. Prior to the investigation, the approximately 300-foot by 300-foot area was staked at four corners (see Figure 2-1). Three geophysical methods were used for the investigation: ground-penetrating radar, magnetics, and electromagnetic induction (EM). Multiple methods were used because each method senses buried objects differently. Appendix B presents a detailed description of the three geophysical methods used during this investigation.

Geonics models EM-31 and EM-61 instruments were used for the electromagnetic portion of the investigation, a Geometrics model 856 was used for the magnetics portion, and a Sensors & Software Noggin GPR unit was used. EM-31 data were collected every 10 feet along southeast-northwest-oriented survey lines spaced 10 feet apart. EM-61 data were collected at stations every 0.6 feet along survey lines spaced 5 feet apart. Magnetics data were sampled every 10 feet along survey lines spaced 20 feet apart. GPR data were monitored continually along survey lines spaced every 20 feet.



Summary Report | Draft Final

APHO 46 and MSC R2 Sampling Locations

APHO 46 and MCS R2

Former MCAS El Toro

Date: 12-03

Project No 37380

EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY

Figure 2-1

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3. DATA EVALUATION

3.1 PHASE I SOIL SAMPLING RESULTS

Table 3-1 presents a summary of all detected analytes for Phase I soil sampling conducted in August 2002. The following subsections present a discussion of the results. Appendix C presents all analytical results.

3.1.1 VOCs

Three VOCs were detected above respective reporting limits in the 11 samples analyzed (all were below their respective residential PRG values) (EPA Region 9 2002). 4-methyl-2-pentanone was detected in four of the samples, with a maximum concentration of 3 micrograms per kilogram (µg/kg). Ethyl tertiary butyl ether was detected in nine of the samples, with a maximum concentration of 3 µg/kg. Toluene was detected in 10 samples, with a maximum concentration of 4 µg/kg.

3.1.2 SVOCs

No SVOCs were detected above reporting limits in any of the 11 samples analyzed.

3.1.3 PAHs

No PAHs were detected above reporting limits in any of the 11 samples analyzed.

3.1.4 Petroleum Hydrocarbons

Petroleum hydrocarbons were detected in all 11 samples. Petroleum hydrocarbons as gasoline were detected at concentrations ranging from 0.1 milligrams per kilogram (mg/kg) to 0.5 mg/kg. Petroleum hydrocarbons as diesel fuel were detected at concentrations ranging from 5 mg/kg to 120 mg/kg. Petroleum hydrocarbons as motor oil were detected at concentrations ranging from 130 mg/kg to 1,200 mg/kg.

The concentrations were higher for heavier hydrocarbons and lower for lighter hydrocarbons. This is most likely due to higher volatility of the lighter hydrocarbons compared to that of heavier hydrocarbons, as well as the presence of asphalt-like material encountered at the sampling locations.

3.1.5 Organochlorine Pesticides

Alpha-chlordane was detected in eight samples, with a maximum concentration of 2 µg/kg. Gamma-chlordane was detected in 10 samples, with a maximum concentration of 2 µg/kg. 4,4′-dichlorodiphenyldichloroethane (4,4′-DDD) was detected in all 11 samples, with a maximum concentration of 27 µg/kg. 4,4′-dichlorodiphenyldichloroethylene (4,4′-DDE) was detected in all 11 samples, with a maximum concentration of 23 µg/kg. 4,4′-dichlorodiphenyltrichloroethane (4,4′-DDT) was detected in all 11 samples, with a maximum concentration of 64 µg/kg. All concentrations were below EPA Region 9 residential PRG values (EPA Region 9 2002) and MCAS El Toro background values (BNI 1996c).

3.1.6 PCBs

Aroclor 1260 was detected in all 11 samples, with a maximum concentration of 37 µg/kg, which is below the residential PRG value of 220 µg/kg (EPA Region 9 2002). No other PCBs were detected above reporting limits.

3.1.7 Chlorinated Herbicides

No chlorinated herbicides were detected above reporting limits in any of the 11 samples analyzed.

3.1.8 Metals

Nineteen metals were detected above reporting limits including aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, vanadium, and zinc. Of those, copper, lead, mercury, silver, and zinc were detected above MCAS El Toro background levels (BNI 1996c). Copper was detected at a maximum concentration of 36.7 mg/kg. Lead was detected at a maximum concentration of 73.2 mg/kg. Mercury was detected at a maximum concentration of 1.5 mg/kg. Silver was detected at a maximum concentration of 1.1 mg/kg. Zinc was detected at a maximum concentration of 122 mg/kg. All metals detected above MCAS El Toro background levels had concentrations below EPA Region 9 residential PRG values (EPA Region 9 2002).

3.1.9 Dioxins

A residential PRG is only available for 2,3,7,8-TCDD. Therefore, for each sample, the concentration (or one-half of the quantitation limit for nondetects) of each dioxin/furan congener was multiplied by a toxicity equivalency factor (TEF) to convert the concentration to an equipotent concentration of 2,3,7,8-TCDD (EPA Region 9 2002). Ten samples had toxicity equivalents above the EPA Region 9 residential PRG value of 3.9 picograms per gram (pg/g), although all of the values were below the EPA Region 9 industrial PRG value of 20 pg/g.

3.2 PHASE II SOIL SAMPLING RESULTS

As in the case of Phase I dioxins data, for each Phase II soil sample, the concentration (or one-half of the quantitation limit for nondetects) of each dioxin/furan congener was multiplied by a TEF to convert the concentration to an equipotent concentration of 2,3,7,8-TCDD (EPA Region 9 2002). For comparison purposes, the results are presented in Table 3-1, along with the results from the Phase I soil sampling. Three of the 7 samples had toxicity equivalents above the EPA Region 9 residential PRG value of 3.9 pg/g, although all of the values were below the EPA Region 9 industrial PRG value of 20 pg/g.

The results of the Phase II sampling show that dioxin concentrations at location APHO46-SS01 (see Figure 2-1) decrease with depth. Additionally, dioxin concentrations at location APHO46-SS07 are consistent with Phase I sampling results, and dioxin concentrations at locations APHO46-SS08 and APHO46-SS09 are lower than Phase I sampling results.

3.3 DIOXIN DATA ADEQUACY ASSESSMENT

The *Final Work Plan, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2002) included the following decision rule as part of the APHO 46 DQOs: "If the results of the soil sampling are adequate to verify whether releases occurred and to conduct a screening risk assessment, then no further sampling will be required (Decision 1)." The following data quality assessment is included here to comply with the pre-design investigation DQOs (as well as *Final Sampling and Analysis Plan, Amendment Number 1, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California* [Earth Tech 2003a]) and to evaluate whether soil sampling was adequate to conduct a screening risk assessment.

Subsequent to Phase I sampling, to illustrate that 10 soil samples are adequate for evaluation of the debris pile (11 total samples, including one duplicate), the number of random samples required to run a statistical test (one-sample t-test) to test the hypothesis "whether the concentrations of dioxins found in the investigation area are above the residential PRG established for 2,3,7,8- TCDD (the main risk driver)," was calculated. The following assumptions were used in the calculation:

1. Null Hypothesis: The true mean of 2,3,7,8-TCDD toxicity equivalence (TEQ) is greater than or equal to the residential PRG for 2,3,7,8-TCDD.
2. The data are normally distributed based on a Shapiro-Wilk test for normality.
3. False rejection rate (probability of rejecting null hypothesis when in fact it is true) of 5 %.
4. False acceptance rate (probability of accepting null hypothesis when in fact it is false) of 20 %.
5. Standard deviation of 2.43 (calculated from the actual results obtained from the Phase I soil sampling).
6. Width of gray region (delta) of 2.43 (the width of the gray region was set at 1 standard deviation. This provides sufficient assurance of the conclusion that the mean is indeed greater than the PRG).

Based on these assumptions, the minimum number of samples required to run a one-sample t-test was calculated to be 8, using the following formula (EPA 1998):

$$n = \frac{S_T^2 \left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{\Delta^2} + 0.5\, Z_{1-\alpha}^2$$

where

n = recommended minimum sample size

S_T = estimated standard deviation due to both sampling and analytical variability

$Z_{1-\alpha}$ = value of the standard normal distribution for which the proportion of the distribution to the left of $Z_{1-\alpha}$ is $1-\alpha$

$Z_{1-\beta}$ = value of the standard normal distribution for which the proportion of the distribution to the left of $Z_{1-\beta}$ is $1-\beta$

Δ = width of the gray region

Subsequent to Phase II sampling, an additional data adequacy evaluation was conducted for the dioxin samples, using the revised standard deviation of 2.69, and re-testing for normality. Again, the data were found to be normally distributed, and using a standard deviation of 2.69 resulted in a need to collect a total of 8 samples. Therefore, the site has been adequately characterized with 16 samples (10 random and 6 judgmental plus 2 duplicates) analyzed for dioxins.

3.4 Risk Screening at APHO 46

A screening risk assessment (Phase I risk screening) was conducted at APHO 46 after the Phase I soil sampling and the results were presented in the *Draft Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2003b). Following Phase II soil sampling, the risk screening (Phase II risk screening) was revised at APHO

46 by incorporating additional dioxin sampling results. The approach used in the Phase I and Phase II risk screenings is described in the following sections.

3.4.1 Risk Screening Approach

3.4.1.1 *Identification of Chemicals of Potential Concern*

For Phase I risk screening, chemicals of potential concern (COPCs) were identified as the chemicals that were detected in at least one soil sample during Phase I soil sampling. VOCs, petroleum hydrocarbons, organochlorine pesticides, PCBs, metals, and dioxins were detected in the soil at APHO 46 during Phase I soil sampling. All detected chemicals with the exception of ethyl tertiary butyl ether and petroleum hydrocarbons, which did not have PRG values, were retained as COPCs. For Phase II risk screening, same COPCs were used as in Phase I risk screening along with the incorporation of the Phase II dioxins data.

3.4.1.2 *Exposure Point Concentration Estimation*

During Phase I risk screening, maximum detected concentrations of the COPCs during Phase I soil sampling were used as exposure point concentrations (EPC). During Phase II risk screening, reasonable maximum exposure (RME) EPCs, which corresponds to the highest exposure that is reasonably expected to occur at the site was calculated for each COPC. The value of RME EPC was estimated for each COPC by calculating the 95 percent upper confidence limit (UCL) of the mean concentration, and comparing it with its maximum detected concentration; the lesser of the two values (95 percent UCL and maximum detected concentration) was then used as the RME EPC for the COPC.

The calculation of the 95 percent UCL of the mean concentrations of COPCs at APHO 46 was in accordance with the EPA guidance documents (EPA 2002b and EPA 1992). Following rules were used for data evaluation and reduction for 95 percent UCL calculation:

1. Nondetected values were represented by one-half the sample reporting limit.
2. Field duplicates were used in the following manner in the calculation:
   - The original sample and field duplicate results were averaged when both were detected quantities.
   - When one sample or the other was "nondetect", the "nondetect" concentration was averaged with the detected concentration using a value of ½ the sample reporting limit for the "nondetect." If there was a qualifier on the detected concentration, that qualifier remained with the averaged value.
   - When both samples were "nondetect", the two values were averaged using the full reporting limit.

After the data were evaluated using the above-mentioned rules, the Shapiro-Wilk Test was used to assess if the distribution of analytical concentrations of the COPCs is normal or lognormal. If the analytical concentrations of a COPC followed normal distribution, the Student's *t*-statistic was used; and if the analytical concentrations of a COPC followed lognormal distribution, the Land method was used to calculate the 95 percent UCL. If neither normal nor lognormal distribution was found to be applicable for the analytical concentrations of a COPC, the Jackknife method, which is a recommended nonparametric method for small sample sizes in EPA (2002b) guidance, was used to calculate the 95 percent UCL. Table 3-2 presents 95 percent UCLs for the COPCs at APHO 46 along with the distributions and methods used to calculate them.

3.4.1.3 RISK QUANTITATION

During Phase I risk screening, the maximum detected concentrations of each COPC were compared to the residential PRG values, creating a risk ratio for each detected analyte such that the risk ratio of greater than 1 indicated a maximum excess cancer risk of greater than 10^{-6}. During Phase II risk screening, the RME EPCs for each COPC were compared to both carcinogenic residential PRG risk screening values (to calculate the excess cancer risk at the site) and noncarcinogenic residential PRG risk screening values (to calculate the hazard index [HI]).

For both cumulative carcinogenic risk and non-carcinogenic hazard, two values were calculated. One value was calculated by including the metals within background (i.e., considering the metals as COPCs even if they were detected at concentrations below the background concentrations for MCAS El Toro), and the second value was calculated by excluding the metals within background (i.e. not considering the metals as COPCs if they were not detected above background in any of the samples). It should be noted that carcinogenic and non-carcinogenic risk values excluding metals within background are more representative of the risk at APHO 46 due to the historical activities at the site.

3.4.2 Risk Screening Results

The results of Phase I and Phase II risk screenings are summarized in Table 3-3. For Phase I risk screening using the maximum detected concentrations of COPCs, the cumulative risk ratio, including metals within background values for MCAS El Toro, was calculated to be 17.6. Excluding metals within background resulted in a risk ratio of 3.8. Dioxins contribute a risk ratio of 3.03. The major contributors to risk included arsenic and dioxins, however since all the detected concentrations of arsenic were below the MCAS El Toro background value of 6.86 mg/kg, the primary risk drivers were considered to be dioxins. All other analytes were considered not to pose a risk to human health or the environment.

The cumulative carcinogenic risk (including metals within background) due to potential exposure to RME EPCs at APHO 46 is 1.3E–05, which is above the EPA point of departure risk level of 10^{-6}, but below the action level (10^{-4}) typically associated with remediation requirements. The RME EPCs for arsenic (4.1 mg/kg), 2,3,7,8-TCDD TEQ (6.2 pg/g), and cadmium (1.5 mg/kg), account for 78, 15, and 6 percent of the risk, respectively. The RME EPCs for arsenic and dioxins (expressed as equipotent concentration of 2,3,7,8-TCDD) exceeded their respective carcinogenic residential PRGs.

The cumulative carcinogenic risk (excluding metals within background) due to potential exposure to RME EPCs at APHO 46 is 2.1E-06, which is slightly higher than the EPA point of departure risk level of 10^{-6}. Dioxins contribute a risk of 1.9E-06, representing 93 percent of the cumulative risk.

The cumulative HI (including metals within background) based on the RME EPCs is estimated to be 2.1, and is above the target HI of 1. The major contributors to HI include cadmium (39 percent), iron (30 percent), arsenic (9 percent), aluminum (6 percent), and manganese (6 percent).

The cumulative HI (excluding metals within background) based on the RME EPCs at APHO 46 is less than 1.

3.5 GEOPHYSICAL INVESTIGATION AT MSC R2

All field data collected during the geophysical investigation were downloaded from field instruments. It was apparent during the investigation that local site conditions prevented the GPR unit from penetrating the soil more than about 2 feet. Magnetic and EM data showed good agreement with each other.

EM-31 and EM-61 data, as well as magnetic data, showed good agreement with each other, and revealed the presence of buried piping, primarily on the golf course portion of the grid. There was no evidence of landfilling activities at MSC R2. Appendix B contains a more complete analysis, as well as figures illustrating the results of the investigation.

Table 3-1: Summary of Detected Analytes

Analyte	Units	MCAS El Toro Background Concentration* (0.95 Quantile)	Residential PRG (µg/kg)	Industrial PRG (µg/kg)	APHO46-SS01 0 5 feet bgs LI001	APHO46-SS01 1 foot bgs LI007	APHO46-SS01 2 feet bgs LI008	APHO46-SS01 2 feet bgs (dup) LI009	APHO46-SS01 2 5 feet bgs LI059	APHO46-SS01 5 feet bgs LI060	APHO46-SS01 10 feet bgs LI061
VOCs											
4-Methyl-2-Pentanone (MIBK)	µg/kg	--	7.9E+05	2.8E+06	2 J	5.5 U	5.1 U	5 3 U	NA	NA	NA
Ethyl Tertiary Butyl Ether	µg/kg	--	--	--	3 J	3 J	2 J	5.3 U	NA	NA	NA
Toluene	µg/kg	--	5.2E+05	5.2E+05	4 J	3 J	3 J	4 J	NA	NA	NA
PCBs											
Aroclor 1260	µg/kg	--	2.2E+02	7.4E+02	37	19 J	19 J	28 J	NA	NA	NA
Organochlorine Pesticides											
Alpha-Chlordane	µg/kg	2.24	1.6E+03	6.5E+03	0 7 J	2	0 7 J	1 J	NA	NA	NA
Gamma-Chlordane	µg/kg	2.7	1.6E+03	6.5E+03	2	2	2	2	NA	NA	NA
4 4'-DDD	µg/kg	36 1	2 4E+03	1.0E+04	13	27	20	27	NA	NA	NA
4 4'-DDE	µg/kg	145	1 7E+03	7 0E+03	11	8.3	11	16	NA	NA	NA
4,4'-DDT	µg/kg	236	1.7E+03	7.0E+03	39	47	40	64	NA	NA	NA
Petroleum Hydrocarbons											
Motor Oils	mg/kg	--	--	--	510	1,200	820	900	NA	NA	NA
PHC as Diesel Fuel	mg/kg	--	--	--	61 J	120	67 J	68 J	NA	NA	NA
PHC as Gasoline	mg/kg	--	--	--	0.2 J	0.1 J	0.2 J	0.2 J	NA	NA	NA
Metals			mg/kg	mg/kg							
Aluminum	mg/kg	14,800	7 6E+04	1 0E+05	7,960	8,240	9,290	10,600	NA	NA	NA
Antimony	mg/kg	3.06	3 1E+01	4 1E+02	0 81 UJ	2 4	0 46 UJ	0 66 UJ	NA	NA	NA
Arsenic	mg/kg	6.86	3.9E-01	1 6E+00	3.4	4.5	3.9	3.7	NA	NA	NA
Barium	mg/kg	173	5.4E+03	6.7E+04	86.1	113	100	106	NA	NA	NA
Cadmium	mg/kg	2.35	1 7E+00	7 4E+00	1	1.6	0.94	1.1	NA	NA	NA
Calcium	mg/kg	46,000	--	--	5,130	9 400	9 970	11,700	NA	NA	NA
Chromium	mg/kg	26.9	3.0E+01	6.4E+01	8 7	11.5	11.1	10.9	NA	NA	NA
Cobalt	mg/kg	6.98	9.0E+02	1 9E+03	4.4	4.9	5.4	5.7	NA	NA	NA
Copper	mg/kg	10.5	3.1E+03	4 1E+04	**14.7**	**36.7**	**19.6**	**34.5**	NA	NA	NA
Iron	mg/kg	18,400	2.4E+04	1 0E+05	10,600	14,600	12,600	14,300	NA	NA	NA
Lead	mg/kg	15.1	1 5E+02	--	**23.7**	**73.2**	**25.1**	**28.3**	NA	NA	NA
Magnesium	mg/kg	8,370	--	--	3,680	3,990	4,310	4,940	NA	NA	NA
Manganese	mg/kg	291	1 8E+03	1 9E+04	180	221	207	240	NA	NA	NA
Mercury	mg/kg	0.22	2.4E+01	3.1E+02	0 097	1.5	0.11	0.18	NA	NA	NA
Nickel	mg/kg	15.3	1 6E+03	2.0E+04	8	11.3	10.2	10	NA	NA	NA
Potassium	mg/kg	4,890	--	--	2,320	2,140	2,340	2,350	NA	NA	NA
Silver	mg/kg	0.539	3.9E+02	5 1E+03	0.33 UJ	**1.1**	0 078 UJ	0.29 UJ	NA	NA	NA
Vanadium	mg/kg	71 8	5.5E+02	7 2E+03	23.5	27.4	29.7	33 6	NA	NA	NA
Zinc	mg/kg	77.9	2.4E+04	1.0E+05	69.6	**122**	74.2	**91.1**	NA	NA	NA
Dioxins			pg/g	pg/g							
2 3,7 8-TCDD	pg/g	--	--	--	0 297	0.547	0 311	0 356	0.224	0 293	0 294 U
1 2 3,4 7 8-PeCDD	pg/g	--	--	--	0 591	1 99	0.855	1 11	0.524 UJ	0 841	0.294 U
1,2,3,4,7,8-HxCDD	pg/g	--	--	--	0.974	2 63	1 05	1 23	0 504 UJ	1 18	0.306 U
1,2,3,6,7,8-HxCDD	pg/g	--	--	--	2.09	4.29	2 02	2.44	1 44	2.13	0.635
1 2 3 7 8 9-HxCDD	pg/g	--	--	--	1.8	3.3	1.63	1.99	1.26	1.74	0 546 UJ
1,2,3,4 6 7.8-HpCDD	pg/g	--	--	--	21.8	37.1	21	26.6	13.4	15.9	20.4
OCDD	pg/g	--	--	--	129	186	120	168	87.4	69	182
2 3,7,8-TDCF	pg/g	--	--	--	1 38	3.17	1 53	1.68	0 945	1 64	0.174 UJ
1 2 3 7 8-PeCDF	pg/g	--	--	--	1.49	4 27	1.79	2 18	0.748	2 01	0.294 U
2,3,4,7 8-PeCDF	pg/g	--	--	--	3.36	7 99	3.43	3.49	1 51	3 54	0.158 UJ
1,2,3,4,7,8-HxCDF	pg/g	--	--	--	3 33	9.35	3.6	4.69	1 41	4.77	0 320 U
1 2 3.6 7 8-HxCDF	pg/g	--	--	--	2 62	7.08	2.94	3 48	1.17	3 49	0.294 U
2.3 4.6 7 8-HxCDF	pg/g	--	--	--	4.14	11.4	4 41	5 02	1.65	5 49	0.312 U
1,2,3,7,8,9-HxCDF	pg/g	--	--	--	1.04	1.99	1.01	1.34	0 591 UJ	1.02	0.387 U
1,2,3,4,6,7 8,-HpCDF	pg/g	--	--	--	14.4	34.5	14.2	17.9	7.12	21.7	0.849
1,2,3,4 7 8.9-HpCDF	pg/g	--	--	--	1.1	2.47	1.12	1.39	0.805	1 25	0.294 U
OCDF	pg/g	--	--	--	12.2	24.3	12.3	13.2	6.25	9.36	2.31
Total TCDDs	pg/g	--	--	--	2.73	15.5	3.98	2 18	1 26	2.06	0.282
Total PeCDDs	pg/g	--	--	--	9.76	35 7	11.2	7.18	5.24	12 3	0.550 U
Total HxCDDs	pg/g	--	--	--	28.8	71 7	29.9	36.8	13 9	28.9	4.88
Total HpCDDs	pg/g	--	--	--	49 9	92.8	47 8	73.4	27.2	33.4	37
Total TCDFs	pg/g	--	--	--	18 4	67.5	25.8	16 3	12.1	24.4	0.419
Total PeCDFs	pg/g	--	--	--	35.6	94.2	39 1	40 2	18.1	43	0.985
Total HxCDFs	pg/g	--	--	--	32 7	89	36 4	40.9	16 4	39.8	0 896 UJ
Total HpCDFs	pg/g	--	--	--	23.6	45.3	21.5	27.5	11.9	29	2.72
2,3,7,8-TCDD TEQ	pg/g	--	3.9E+00	1.6E+01	**4.77E+00**	**1.18E+01**	**5.17E+00**	**5.98E+00**	2.34E+00	**5.55E+00**	7.54E-01

Analyte	APHO46-SS02 0 5 feet bgs LI002	APHO46-SS02 2 feet bgs LI010	APHO46-SS03 0 5 feet bgs LI003	APHO46-SS04 0 5 feet bgs LI004	APHO46-SS05 0 5 feet bgs LI005	APHO46-SS06 0 5 feet bgs LI006	APHO46-SS06 2 feet bgs LI011	APHO46-SS07 0 5 feet bgs LI055	APHO46-SS07 0 5 feet bgs (dup) LI058	APHO46-SS08 0 5 feet bgs LI056	APHO46-SS09 0 5 feet bgs LI057
VOCs											
4-Methyl-2-Pentanone (MIBK)	3 J	5.6 U	2 J	1 J	5.2 U	5.3 U	5 5 U	NA	NA	NA	NA
Ethyl Tertiary Butyl Ether	3 J	3 J	3 J	2 J	3 J	2 J	5.5 U	NA	NA	NA	NA
Toluene	4 J	3 J	4 J	3 J	3 J	3 J	5.5 U	NA	NA	NA	NA
PCBs											
Aroclor 1260	22 J	17 J	8 J	11 J	17 J	15 J	10 J	NA	NA	NA	NA
Organochlorine Pesticides											
Alpha-Chlordane	1 0 U	0.4 J	1.0 U	0.6 J	1	1.0 U	0.5 J	NA	NA	NA	NA
Gamma-Chlordane	2	2	0.6 J	1	1.0 U	1	0.9 J	NA	NA	NA	NA
4 4'-DDD	11	15	6	11	23	8 3	15	NA	NA	NA	NA
4 4'-DDE	16	9.6	23	20	7 3	7 7	6	NA	NA	NA	NA
4,4'-DDT	41	27	18	23	41	21	28	NA	NA	NA	NA
Petroleum Hydrocarbons											
Motor Oils	580	1,200	130	380	490	300	330	NA	NA	NA	NA
PHC as Diesel Fuel	39 J	70 J	5 J	19 J	22 J	9 J	13 J	NA	NA	NA	NA
PHC as Gasoline	0.5 J	0.3 J	0.2 J	0.2 J	0.3 J	0.1 J	0.2 J	NA	NA	NA	NA
Metals											
Aluminum	10,900	10,000	11,900	9,750	5,570	8,950	8,870	NA	NA	NA	NA
Antimony	0 82 UJ	6.5 U	0.29 UJ	1.3 UJ	0.43 UJ	1.1 UJ	0 64 UJ	NA	NA	NA	NA
Arsenic	3.9	3.9	3.9	4	2.4	3.5	3.3	NA	NA	NA	NA
Barium	117	94.8	117	113	62	108	97.9	NA	NA	NA	NA
Cadmium	1.2	0.75	1.4	1.7	0.6	1.3	0.74	NA	NA	NA	NA
Calcium	5.650	8,090	4,750	6 320	3,900	5,720	6 800	NA	NA	NA	NA
Chromium	12.7	11.4	12.2	10.3	6.6	10.8	10	NA	NA	NA	NA
Cobalt	5.5	5.6	5.3	5.4	3.3	5.7	5	NA	NA	NA	NA
Copper	**24.6**	**16.1**	**12.7**	**31.9**	**10.9**	**32.1**	**16.1**	NA	NA	NA	NA
Iron	14,900	13,400	15,300	14,300	7,720	16,400	11,900	NA	NA	NA	NA
Lead	**22.6**	**17.8**	12.3	**25**	**19.5**	**44.6**	**17.1**	NA	NA	NA	NA
Magnesium	4,670	4,530	4,870	4,810	2,710	4,640	4,360	NA	NA	NA	NA
Manganese	226	219	234	247	137	245	208	NA	NA	NA	NA
Mercury	0.091	0.08	0 044	0.098	0.14	0.12	0.075	NA	NA	NA	NA
Nickel	11.2	13.6	10.4	10.3	7.4	10.5	9.7	NA	NA	NA	NA
Potassium	3,190	2,370	3,700	2 640	1,620	2,790	2 200	NA	NA	NA	NA
Silver	0 26 UJ	1.1 U	0 053 UJ	0.39 J	0.51 U	**0.8**	1.0 U	NA	NA	NA	NA
Vanadium	30.9	32 2	31 5	29.1	18	26 9	26.7	NA	NA	NA	NA
Zinc	75.4	58.6	59.4	**82.4**	45.3	**112**	62.4	NA	NA	NA	NA
Dioxins											
2 3,7 8-TCDD	0.159 U	0 286	0.202	0.297	0.251	0.279	0.216 U	0 279 U	0.292	0 195	0.111 U
1 2 3,4 7 8-PeCDD	0.735	0 686	0.398	0 647	0.876	1.14	0 681	1 15	0.996	0.803	0.312 UJ
1,2,3,4,7,8-HxCDD	1 21	0.867	0.545	0.876	1.27	1 44	0.828	1.19	1.03	0 338 UJ	0 179 UJ
1,2,3,6,7,8-HxCDD	3	1.55	1 46	1.8	2.27	2.82	1.65	2.72	2 47	2 27	1 33
1 2 3 7 8 9-HxCDD	2.39	1.28	1.42	1.49	2.02	2.3	1.47	2.27	2.13	2.09	1.63
1,2,3,4 6 7.8-HpCDD	42.8	16.9	19	14 8	21	28.3	13	33	34.9	20.3	12.9
OCDD	304	109	253	84.5	120	161	64 4	194	209	157	121
2 3,7,8-TDCF	1.29	1 25	0 727	1.31	1 29	1 79	1.16	2.29	1 95	0 509	0.43
1 2 3 7 8-PeCDF	2.13	1 33	0.705	1 73	1 61	2.47	1.45	2.4	2 13	0.513 UJ	0.315 UJ
2,3,4,7 8-PeCDF	3.7	2.49	1 33	3.15	2.61	5 05	2 55	4.41	3.79	1 53	0 481 UJ
1,2,3,4,7,8-HxCDF	5 99	3.04	1 23	3.37	3.72	5 53	3.07	5.26	4 35	1.46	0 337 UJ
1 2 3.6 7 8-HxCDF	4.78	2 37	1.04	2.71	2.8	4.36	2.47	4.3	3 62	0.838	0.362 UJ
2.3 4.6 7 8-HxCDF	7.1	3.35	1.54	3 98	4.56	6.8	3.72	6.05	4.82	0.801	0 438 UJ
1,2,3,7,8,9-HxCDF	2.48	0.654	0.776	1.2	1.08	1.64	0.754	1.24	0.85	1 11	0.849
1,2,3,4,6,7 8,-HpCDF	30.8	11.7	6.14	14.7	15.7	27.1	12.7	24.5	20.4	9 53	4.76
1,2,3,4 7 8.9-HpCDF	4.85	1.03	0.423	1.15	1.26	1.89	1.01	1.34	1.06	0.54	0.267
OCDF	42.1	11.5	11	10.9	13.3	21.5	8.15	14.8	14.5	14	16.7
Total TCDDs	3.48	2.69	1 08	4.02	1 95	5.45	2.24	4.13	6.14	12 6	0.796
Total PeCDDs	7.77	7.32	5.07	8.41	9.07	15.4	6.06	16 3	13.1	14.6	3.07
Total HxCDDs	36.5	22.8	17 1	23.3	31	39 7	23.9	37.4	32.7	16.6	8.2
Total HpCDDs	88.3	38.1	43.4	35.9	44 3	60 2	27.7	74.9	77 9	37 8	24.7
Total TCDFs	18.9	18 9	14.5	20.2	10 7	33.1	14	40	36 1	10.6	6.16
Total PeCDFs	43 9	30.3	14 1	32.6	28.7	51 8	26 4	50	38.1	11 3	7 58
Total HxCDFs	58.2	27 9	13 1	31.6	31 3	50 2	27.4	49 9	42 2	15.6	8.07
Total HpCDFs	53.9	16.3	11.2	21.8	24.3	39.7	18.6	35.8	29.8	16.4	11.7
2,3,7,8-TCDD TEQ	**6.41E+00**	**4.03E+00**	2.46E+00	**4.60E+00**	**4.81E+00**	**7.33E+00**	**3.92E+00**	**6.76E+00**	**6.00E+00**	3.02E+00	1.02E+00

Notes:

-- Indicates that the specified regulatory threshold or MCAS El Toro Background concentration does not exist.

* MCAS El Toro background concentrations taken from *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations, Marine Corps Air Station El Toro* (BNI 1996c)

For all analytes except metals, concentrations in bold indicate values above EPA Region IX residential PRGs.

For metals, concentrations in **bold** indicate values above MCAS El Toro background concentrations (BNI 1996c)

U = The analyte was not detected at the threshold indicated

J = The level stated is an estimated value

UJ = The analyte was not detected; however the level stated is an estimated value

NA = not analyzed

HpCDD = heptachlorodibenzodioxin

HpCDF = heptachlorodibenzofuran

HxCDD = hexachlorodibenzodioxin

HxCDF = hexachlorodibenzofuran

OCDD = octachlorodibenzodioxin

OCDF = octachlorodibenzofuran

PeCDD = pentachlorodibenzodioxin

PeCDF = pentachlorodibenzofuran

PHC = petroleum hydrocarbons

TCDD = tetrachlorodibenzodioxin

TCDF = tetrachlorodibenzofuran

Table 3-2: Summary of 95 percent UCL Calculation

Chemical of Potential Concern	Units	Distribution	95 Percent UCL	Method for 95 Percent UCL Calculation
VOCs				
4-Methyl-2-Pentanone (MIBK)	µg/kg	Neither Normal nor Lognormal	2.76	Jackknife
Ethyl Tertiary Butyl Ether	µg/kg	Neither Normal nor Lognormal	2 96	Jackknife
Toluene	µg/kg	Neither Normal nor Lognormal	3.62	Jackknife
PCBs				
Aroclor 1260	µg/kg	Normal	22.81	Normal
Organochlorine Pesticides				
Alpha-Chlordane	µg/kg	Normal	1.03	Normal
Gamma-Chlordane	µg/kg	Neither Normal nor Lognormal	1.78	Jackknife
4,4'-DDD	µg/kg	Normal	19.34	Normal
4,4'-DDE	µg/kg	Normal	15.59	Normal
4,4'-DDT	µg/kg	Normal	40.52	Normal
Petroleum Hydrocarbons				
Motor Oils	mg/kg	Lognormal	1099.92	Lognormal
PHC as Diesel Fuel	mg/kg	Lognormal	141.56	Lognormal
PHC as Gasoline	mg/kg	Normal	0.30	Normal
Metals				
Aluminum	mg/kg	Normal	10221.50	Normal
Antimony	mg/kg	Lognormal	2.37	Lognormal
Arsenic	mg/kg	Normal	3.98	Normal
Barium	mg/kg	Normal	111 12	Normal
Cadmium	mg/kg	Normal	1 35	Normal
Calcium	mg/kg	Normal	7921.09	Normal
Chromium	mg/kg	Normal	11 55	Normal
Cobalt	mg/kg	Neither Normal nor Lognormal	5.49	Jackknife
Copper	mg/kg	Normal	27 68	Normal
Iron	mg/kg	Normal	14744 48	Normal
Lead	mg/kg	Lognormal	41 08	Lognormal
Magnesium	mg/kg	Neither Normal nor Lognormal	4675 29	Jackknife
Manganese	mg/kg	Neither Normal nor Lognormal	233.32	Jackknife
Mercury	mg/kg	Neither Normal nor Lognormal	0.50	Jackknife
Nickel	mg/kg	Normal	11.25	Normal
Potassium	mg/kg	Normal	2870.46	Normal
Silver	mg/kg	Lognormal	1.73	Lognormal
Vanadium	mg/kg	Normal	30.40	Normal
Zinc	mg/kg	Normal	91.00	Normal
Dioxins				
2,3,7,8-TCDD TEQ	pg/g	Normal or Lognormal*	7.55	Lognormal

Notes:

* Dioxin data were found to follow normal as well as lognormal distribution when tested using Shapiro Wilk test, however UCL calculated using lognormal distribution was found to be higher than the UCL calculated using normal distribution. Therefore, lognormal UCL was used for risk calculation.

Table 3-3: APHO 46 Risk Screening Results

									PRG Screening Using Maximum EPC			Risk Corresponding to RME EPC: Carcinogenic			Risk Corresponding to RME EPC: Noncarcinogenic		
Chemical of Potential Concern	Units	MCAS El Toro Background Concentration	Maximum EPC[a]	95% UCL	RME EPC[b]	EPA Region 9 Residential PRG	Residential Carcinogenic Risk Screening Value	Residential Noncarcinogenic Risk Screening Value	Max EPC > PRG?	Risk Ratio[c]	Percent Contribution to Risk Ratio	RME EPC > Carcinogenic Residential PRG Risk Screening Value?	Excess Cancer Risk	Percent Contribution to Cancer Risk	RME EPC > Noncarcinogenic Residential PRG Risk Screening Value?	Hazard Index	Percent Contribution to Hazard Index
VOCs																	
4-Methyl-2-Pentanone (MIBK)	μg/kg	--	3.0E+00	2 8E+00	2.8E+00	7 9E+05	--	7.9E+05	No	<0 01	0%	--	--	--	No	3.5E-06	0%
Ethyl Tertiary Butyl Ether	μg/kg	--	3 0E+00	3.0E+00	3 0E+00	--	--	--	--	--	--	--	--	--	--	--	
Toluene	μg/kg	--	4.0E+00	3.6E+00	3.6E+00	6.6E+05	--	6.6E+05	No	<0.01	0%	--	--	--	No	5.5E-06	0%
PCBs															No		
Aroclor 1260	μg/kg	--	3.7E+01	2.3E+01	2.3E+01	2.2E+02	2.2E+02	--	No	0.17	1%	No	1.0E-07	1%	--	--	--
Organochlorine Pesticides																	
Alpha-Chlordane	μg/kg	2.24	2.0E+00	1.0E+00	1 0E+00	1.6E+03	1.6E+03	3 5E+04	No	<0.01	0%	No	6 4E-10	0%	No	2 9E-05	0%
Gamma-Chlordane	μg/kg	2.7	2.0E+00	1 8E+00	1.8E+00	1 6E+03	1.6E+03	3.5E+04	No	<0.01	0%	No	1 1E-09	0%	No	5.1E-05	0%
4,4'-DDD	μg/kg	36.1	2 7E+01	1.9E+01	1.9E+01	2.4E+03	2 4E+03	--	No	0.01	0%	No	8.1E-09	0%	--	--	--
4,4'-DDE	μg/kg	145	2.3E+01	1 6E+01	1.6E+01	1.7E+03	1.7E+03	--	No	0.01	0%	No	9 2E-09	0%	--	--	--
4,4'-DDT	μg/kg	236	6.4E+01	4.1E+01	4.1E+01	1.7E+03	1.7E+03	3.6E+04	No	0.04	0%	No	2.4E-08	0%	No	1.1E-03	0%
Petroleum Hydrocarbons																	
Motor Oils	mg/kg	--	1.2E+03	1 1E+03	1.1E+03	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	mg/kg	--	1 2E+02	1.4E+02	1 2E+02	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Gasoline	mg/kg	--	5.0E-01	3.0E-01	3.0E-01	--	--	--	--	--	--	--	--	--	--	--	--
Metals																	
Aluminum	mg/kg	14,800	1 2E+04	1.0E+04	1.0E+04	7.6E+04	--	7 6E+04	No	0.16	1%	--	--	--	No	1 3E-01	6%
Antimony	mg/kg	3.06	2.4E+00	2 4E+00	2.4E+00	3 1E+01	--	3.1E+01	No	0.08	0%	--	--	--	No	7.6E-02	4%
Arsenic	mg/kg	6.86	4.5E+00	4.0E+00	4.0E+00	3.9E-01	3.9E-01	2 2E+01	Yes	11.54	66%	Yes	1 0E-05	78%	No	1.8E-01	9%
Barium	mg/kg	173	1.2E+02	1.1E+02	1 1E+02	5.4E+03	--	5 4E+03	No	0.02	0%	--	--	--	No	2 1E-02	1%
Cadmium	mg/kg	2 35	1.7E+00	1 4E+00	1.4E+00	1 7E+00	1.7E+00	1.7E+00	Yes	1.01	6%	No	8 0E-07	6%	No	8 0E-01	39%
Calcium	mg/kg	46,000	1.2E+04	7.9E+03	7 9E+03	--	--	--	--	--	--	--	--	--	--	--	
Chromium	mg/kg	26.9	1.3E+01	1 2E+01	1.2E+01	2.1E+02	2.1E+02	--	No	0.06	0%	No	5 5E-08	0%	--	--	
Cobalt	mg/kg	6.98	5 7E+00	5.5E+00	5.5E+00	9.0E+02	9 0E+02	1.4E+03	No	<0.01	0%	No	6 1E-09	0%	No	4.0E-03	0%
Copper	mg/kg	10.5	3.7E+01	2.8E+01	2 8E+01	3.1E+03	--	3 1E+03	No	0.01	0%	--	--	--	No	8 8E-03	0%
Iron	mg/kg	18,400	1.6E+04	1.5E+04	1.5E+04	2.4E+04	--	2.4E+04	No	0.70	4%	--	--	--	No	6 3E-01	30%
Lead	mg/kg	15.1	7 3E+01	4.1E+01	4.1E+01	1.5E+02	--	--	No	0 49	--	--	--	--	--	--	--
Magnesium	mg/kg	8,370	4.9E+03	4 7E+03	4 7E+03	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	mg/kg	291	2.5E+02	2 3E+02	2.3E+02	1 8E+03	--	1.8E+03	No	0 14	1%	--	--	--	No	1.3E-01	6%
Mercury	mg/kg	0.22	1 5E+00	5.0E-01	5.0E-01	2.3E+01	--	2 3E+01	No	0.07	0%	--	--	--	No	2.2E-02	1%
Nickel	mg/kg	15 3	1.4E+01	1 1E+01	1.1E+01	1 6E+03	--	1.6E+03	No	<0.01	0%	--	--	--	No	7 2E-03	0%
Potassium	mg/kg	4,890	3.7E+03	2.9E+03	2.9E+03	--	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/kg	0.539	1 1E+00	1.7E+00	1.1E+00	3.9E+02	--	3 9E+02	No	<0.01	0%	--	--	--	No	2.8E-03	0%
Vanadium	mg/kg	71 8	3.4E+01	3 0E+01	3.0E+01	5 5E+02	--	5 5E+02	No	0.06	0%	--	--	--	No	5 6E-02	3%
Zinc	mg/kg	77.9	1.2E+02	9.1E+01	9.1E+01	2.4E+04	--	2.4E+04	No	<0.01	0%	--	--	--	No	3.9E-03	0%
Dioxins																	
2,3,7,8-TCDD TEQ	pg/g	--	1.2E+01	7.6E+00	7.6E+00	3.9E+00	3.9E+00	--	Yes	3.03	17%	Yes	1.9E-06	15%	--	--	--
CUMULATIVE RISK (including metals within background)										**17.6**			**1.3E-05**			**2.1**	
CUMULATIVE RISK (excluding metals within background)										**3.8**			**2.1E-06**			**<1**	

Notes:

[a] Maximum EPC is the maximum detected concentration of an analyte

[b] RME EPC is the lesser of either the 95% UCL of the arithmetic mean or the maximum EPC

[c] Risk ratio of greater than 1 indicates carcinogenic risk of greater than 10^{-6}

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 APHO 46

The analytical data for the soil samples collected at APHO 46 indicate that there is no significant contamination. The detected analytes corresponding to all eight contaminant groups with PRGs (VOCs, SVOCs, PAHs, organochlorine pesticides, PCBs, chlorinated herbicides, metals and dioxins), with the exception of dioxins (expressed as equipotent concentration of 2,3,7,8-TCDD) and arsenic, did not exceed their corresponding EPA Region 9 residential PRGs. Arsenic concentrations in all the soil samples were below its MCAS El Toro background value (BNI 1996c).

The Phase II soil sampling data for deep soil samples (2.5 feet, 5 feet, and 10 feet bgs) in the debris pile show that dioxin concentrations decrease with depth in the shallow subsurface and that dioxin concentrations in soil outside of the debris pile area, but within the APHO 46 site boundary are similar to or lower than concentrations in soil within the debris pile. These investigation data indicate that there is no significant release associated with the debris pile.

The risk screening conducted using RME EPCs for the COPCs at APHO 46 shows a cumulative risk estimate of 2.1E–06 (excluding metals within background). The carcinogenic risk due to background concentration of metals at APHO 46 is 1.1E-05. Thus, the carcinogenic risk excluding background metals at APHO 46 is only marginally higher than the EPA point of departure risk level of 10^{-6}, and is well within the EPA established risk management decision range of 10^{-6} to 10^{-4}. The HI for APHO 46 excluding metals with concentrations less than background is less than 1.

Per the NCP preamble (Federal Register, Volume 55, No.49, Page 8717), "Preliminary remediation goals for carcinogens are set at a 10^{-6} excess cancer risk as a point of departure, but may be revised to a different risk level with the acceptable risk range based on the consideration of appropriate factors including, but not limited to: exposure factors, uncertainty factors, and technical factors." Based on the low concentrations of COPCs (an exposure factor), uncertainty in estimating cancer slope factors and TEQs (an uncertainty factor), and low mobility of dioxins (a technical factor), as well as the low carcinogenic risk of 2.1E–06, APHO 46 does not pose unacceptable risk to human health or the environment.

Based on the conclusions cited above and pending the results of the radiological assessment, no further investigation is recommended at APHO 46.

4.2 MSC R2

The field data collected at MSC R2 during the geophysical surveys using methods such as ground penetrating radars, magnetics, and electromagnetic induction, indicated that there is no evidence of waste placement or landfill activities at MSC R2. Therefore, no further investigation is recommended at MSCR2.

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Appendix A
Responses to Comments on Draft Summary Report

Document Title:

(1) Draft Technical Memorandum, Summary Report, Aerial Photograph Anomaly (APHO) 46 and Miscellaneous Refuse Area (MSCR) 2, Former Marine Corps Air Station (MCAS), El Toro, California, January 2003.

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Office of Military Facilities, California Department of Toxic Substances Control; Letter dated February 13, 2003

Comment No.	Section/ Page No.	Comment	Response
After review of the document, DTSC has the following comments:			
1.		Considering that dioxins and furans were detected in all 11 soil samples collected, additional sampling should be conducted to determine the horizontal and vertical extent.	Following the receipt of the present comments on *Draft Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California*, DoN held discussions with the Base Realignment and Closure Cleanup Team (BCT) regarding detection of dioxins and furans in all the samples during the soil sampling conducted at APHO 46 in August 2002. During these meetings, DoN agreed to complete the site characterization by collecting three random surface soil samples outside of the debris pile area but within the site boundary, as well as sampling to 10 feet below ground surface at the location of the highest detected dioxin concentration within the debris pile area. The data quality objectives (DQOs), procedures for field investigation activities, and quality control/quality assurance (QA/QC) requirements for additional soil sampling were presented to the EPA, RWQCB and DTSC in the *Final Sampling and Analysis Plan, Amendment Number 1, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California*. After the approval of the above-mentioned Sampling and Analysis Plan, seven soil samples were collected for dioxin analysis from four locations within APHO 46 in September 2003 and the results have been presented in the *Draft Final Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California*.
2.		Both the cumulative risk (carcinogens) and hazard (non-carcinogens) should be calculated and presented. The screening risk assessment should be conducted as described in the DTSC memorandum, "Recommended Outline for Using U.S. Environmental Protection Agency Region IX Preliminary Remediation Goals [PRGs] in Screening Risk Assessments at Military Facilities," dated October 28, 1994. A screening risk assessment using PRGs can only be used if the potential exposure pathways associated with the site are accounted for in the PRG calculation. Chemicals with PRGs based	The risk screening has been revised to incorporate the results of additional soil sampling conducted in September 2003 at APHO 46. Both the cumulative carcinogenic and non-carcinogenic risks have been calculated and presented in the *Draft Final Technical Memorandum, Summary Report, APHO 46 and MSC R2, Former Marine Corps Air Station, El Toro, California*. The screening risk assessment methodology is consistent with the referenced memorandum.

Document Title:

(1) Draft Technical Memorandum, Summary Report, Aerial Photograph Anomaly (APHO) 46 and Miscellaneous Refuse Area (MSCR) 2, Former Marine Corps Air Station (MCAS), El Toro, California, January 2003.

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Office of Military Facilities, California Department of Toxic Substances Control; Letter dated February 13, 2003

Comment No.	Section/ Page No.	Comment	Response
		on carcinogenic effects are designated with a "ca" and those based on non-carcinogenic effects are designated with a "nc." If the cumulative risk exceeds the screening level of 1×10^{-6} or the hazard exceeds the screening level of 1.0, then further action is required.	
3.	Table 3-2	Table 3-2, PRG Screening Using Maximum Concentrations: Methyl isobutyl ketone (MIBK) is a synonym of 4-methyl-2-pentanone and has a residential PRG in soil of 790 micrograms per kilogram (µg/kg) (United states Environmental Protection Agency, Region IX, October 1, 2002).	The PRG for methyl isobutyl ketone (MIBK) was checked with 2002 EPA Region IX PRGs. The PRG for MIBK is 790 milligrams per kilogram (mg/kg) rather than 790 micrograms per kilogram (µg/kg).
4.	Table 3-2	Table 3-2, PRG Screening Using Maximum Concentrations: Please provide the reference for the PRGs used. Additionally, please verify the residential PRGs listed for metals. For example, copper should be 3,100 milligrams per kilogram (mg/kg) rather than 3,129 mg/kg.	Table 3-2 was verified with the 2002 EPA Region 9 PRGs (EPA 2002) and is correct. The apparent difference in PRGs is the use of scientific notation (i.e 3.1×10^{3} in the published summary table where the actual PRG value is 3129). Notation consistent with the published PRGs has been used.

Document Title:

(1) Draft Technical Memorandum, Summary Report, Aerial Photograph Anomaly (APHO) 46 and Miscellaneous Refuse Area (MSCR) 2, Former Marine Corps Air Station (MCAS), El Toro, California, January 2003.

Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Branch, United States Environmental Protection Agency, Region IX; Letter dated February 25, 2003

Comment No.	Section/ Page No.	Comment	Response
EPA has reviewed the above-referenced document. The report summarizes results from the investigations at APHO 46 and MSCR2, which are both located near IRP Site 5. We have the following comment:			
1.		Given the prevalence of dioxins and furans (detected in all 11 samples), additional sampling should be conducted to determine whether a source exists or if PCBs are found at higher concentrations vertically or horizontally.	Following the receipt of the present comments on *Draft Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California*, DoN held discussions with the Base Realignment and Closure Cleanup Team (BCT) regarding detection of dioxins and furans in all the samples during the soil sampling conducted at APHO 46 in August 2002. During these meetings, DoN agreed to complete the site characterization by collecting three random surface soil samples outside of the debris pile area but within the site boundary, as well as sampling to 10 feet below ground surface at the location of the highest detected dioxin concentration within the debris pile area. The data quality objectives (DQOs), procedures for field investigation activities, and quality control/quality assurance (QA/QC) requirements for additional soil sampling were presented to the EPA, RWQCB and DTSC in the *Final Sampling and Analysis Plan, Amendment Number 1, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station, El Toro, California*. After the approval of the above-mentioned Sampling and Analysis Plan, seven soil samples were collected for dioxin analysis from four locations within APHO 46 in September 2003 and the results have been presented in the *Draft Final Technical Memorandum, Summary Report, APHO 46 and MSCR 2, Former Marine Corps Air Station, El Toro, California*.

Document Title:

(1) Draft Technical Memorandum, Summary Report, Aerial Photograph Anomaly (APHO) 46 and Miscellaneous Refuse Area (MSCR) 2, Former Marine Corps Air Station (MCAS), El Toro, California, January 2003.

Reviewer: John Broderick, California Regional Water Quality Control Board, Santa Ana Region; memo dated May 1, 2003

Comment No.	Section/ Page No.	Comment	Response
We have reviewed the above referenced document, dated January 2003, which we received January 30, 2003.			
1.		We have no comments.	Noted.

Sub Surface Surveys

215 So. Highway 101, Suite 203 P.O. Box 1152 Solana Beach, CA 92075
Telephone: (858) 481-8949 Facsimile: (858) 481-8998 E mail: geop@subsurfacesurveys.com

October 4, 2002

Earth Tech Inc.
100 West Broadway, Suite 240
Long Beach, California 90802-4443

Project No. 02-361

Attn: Crispin Wanyoike

Re: Geophysical Investigation Report, MSCR2, Site 5, Marine Corps Air Station, El Toro, California

This report is to present the results of our geophysical surveys carried out over a portion of Site 5, located at the Marine Corps Air Station, El Toro California (Figure 1) on September 10 & 11, 2002. Based on information supplied by the client, a former refuse area was identified as a possible landfill (MSCR2) in the Final Environmental Survey Report (JEG 1995). The purpose of the geophysical surveys was to scan the area of MSCR2 in an effort to determine if debris is buried here. A combination of ground penetrating radar (GPR), magnetics, and electromagnetic induction (EM) were applied to the search. Geonics models EM-31 and EM-61 instruments were used for the EM sampling. The magnetometer was a Geometrics model 856, and a Sensors & Software Noggin Ground Penetrating Radar unit (equipped with a 500 mHz antenna) produced the radar images.

Multiple methods were utilized because each instrument senses different material properties of the ground and buried objects. At any given site the situation, geologic and cultural, may be such that one or more of the instruments may record excessive "noise", the ground may not provide sufficient contrasts, or there may be overlapping anomalies, for a given instrument to be effective. Summarily stated, there are generally instrumental limits and interpretational impediments.

Survey Design – The position of the MSCR2 search area is shown on Figure 2, southwest of the Perimeter Road Landfill. The survey area measured 90,000 ft^2. Due to the openness of the area, a formal rectilinear grid measuring 300 X 300 feet was established to guide data acquisition. EM-31 data were collected at stations every ten feet along southeast-northwest oriented survey lines spaced ten feet apart. EM-61 data were collected at stations every 0.6 feet along survey lines spaced five feet apart. Magnetics data were sampled every ten feet along survey lines spaced twenty feet apart. GPR data was monitored continuously along survey lines spaced every twenty feet. Figure 3 is presented to illustrate the geophysical instrumentation in use on the site.

Sub Surface Surveys

SITE LOCATION MAP

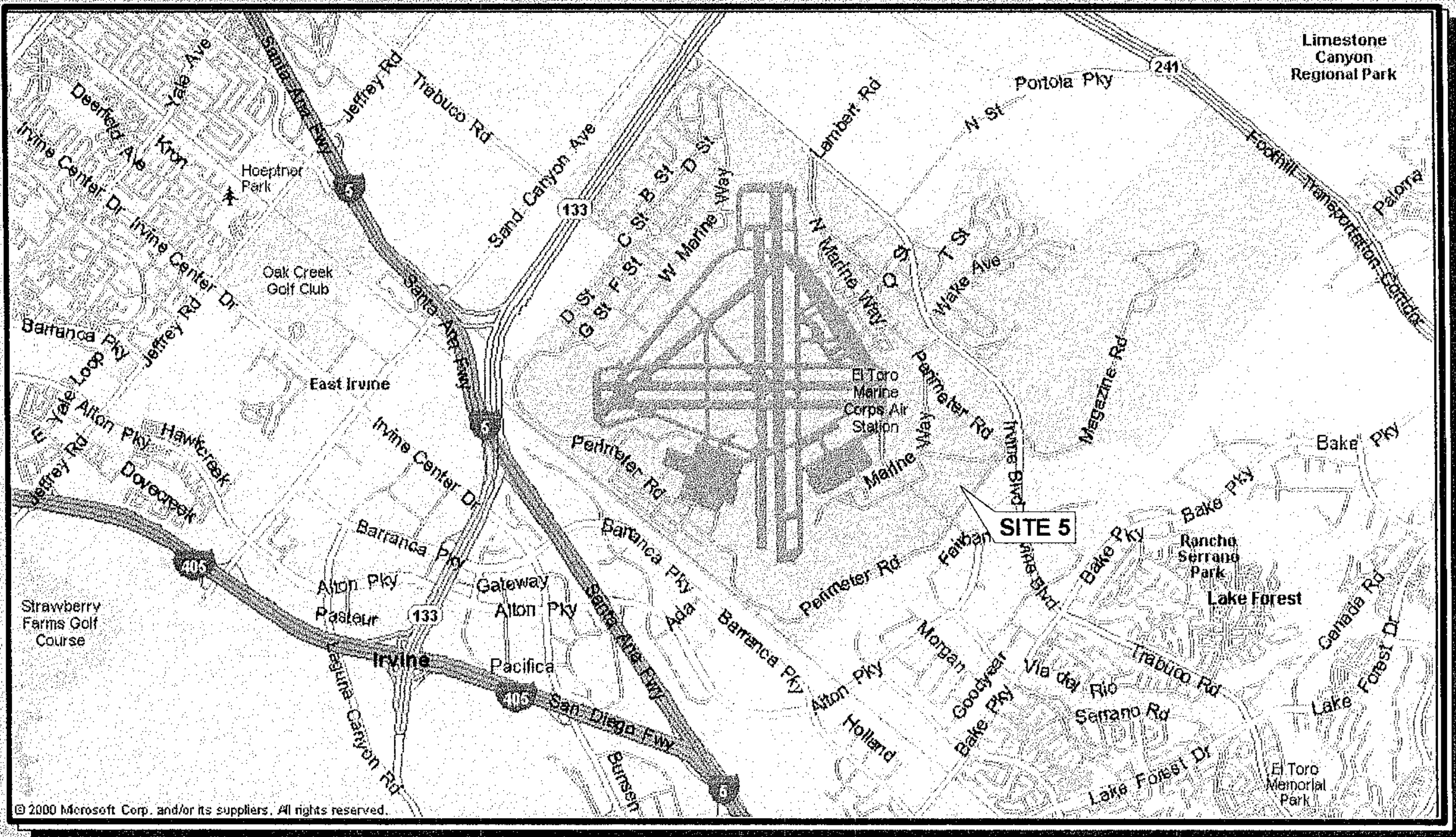
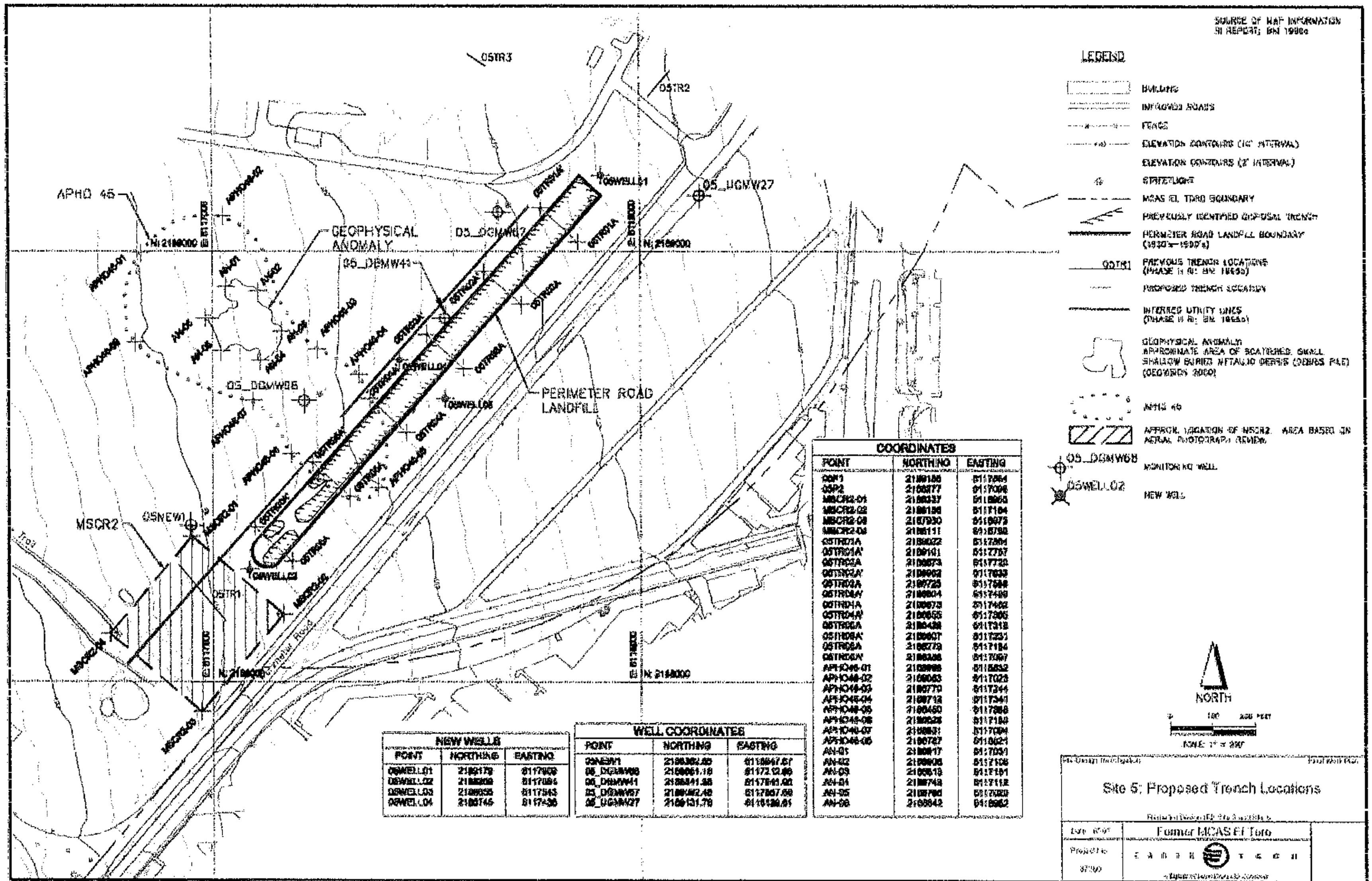


FIGURE 1

Sub Surface Surveys

SITE PLAN

SITE 5



NEW WELLS		
POINT	NORTHING	EASTING
05WELL01	2189179	6117909
05WELL02	2188809	6117094
05WELL03	2188055	6117543
05WELL04	2188745	6117436

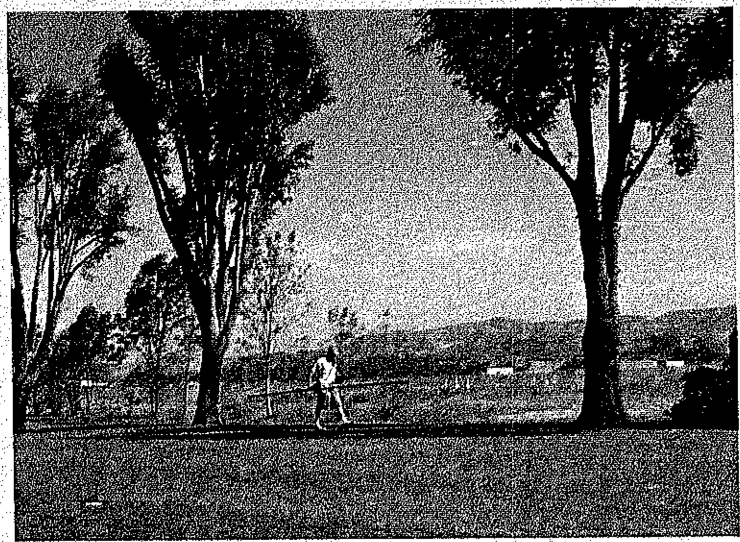
WELL COORDINATES		
POINT	NORTHING	EASTING
05NEW1	2188302.85	6116847.57
05_DGMW06	2188861.18	6117212.80
05_DGMW41	2188541.38	6117641.90
05_DGMW57	2188942.49	6117867.59
05_UGMW27	2189131.79	6118139.61

COORDINATES		
POINT	NORTHING	EASTING
05P1	2189186	6117864
05P2	2188877	6117096
MSCR2-01	2188337	6116865
MSCR2-02	2188156	6117104
MSCR2-03	2187930	6116873
MSCR2-04	2188111	6116792
05TR01A	2189022	6117804
05TR01A'	2189101	6117757
05TR02A	2188873	6117728
05TR02A'	2188902	6117633
05TR03A	2188725	6117588
05TR03A'	2188804	6117499
05TR04A	2188673	6117462
05TR04A'	2188655	6117305
05TR05A	2188428	6117318
05TR05A'	2188507	6117231
05TR06A	2188779	6117184
05TR06A'	2188308	6117097
APHO46-01	2188968	6116852
APHO46-02	2189043	6117023
APHO46-03	2188779	6117244
APHO46-04	2188712	6117341
APHO46-05	2188450	6117368
APHO46-06	2188528	6117193
APHO46-07	2188831	6117094
APHO46-08	2188787	6116821
AN-01	2188817	6117031
AN-02	2188806	6117106
AN-03	2188518	6117181
AN-04	2188748	6117112
AN-05	2188790	6117020
AN-06	2188842	6116862

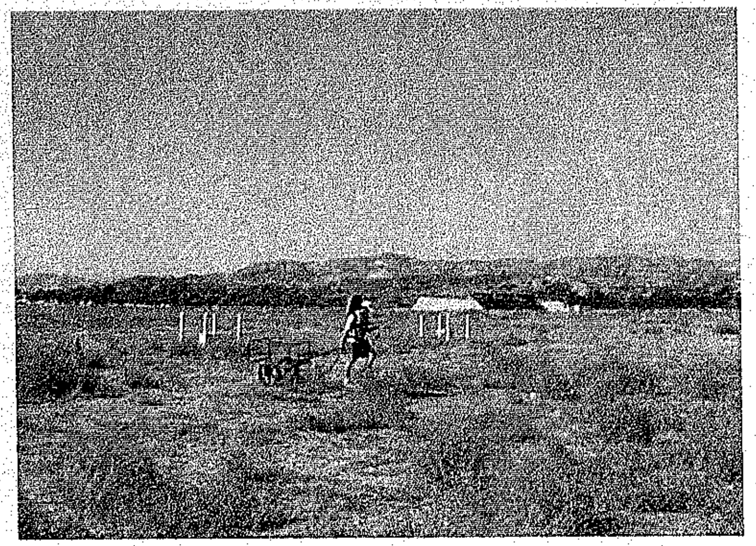
FIGURE 2

Sub Surface Surveys

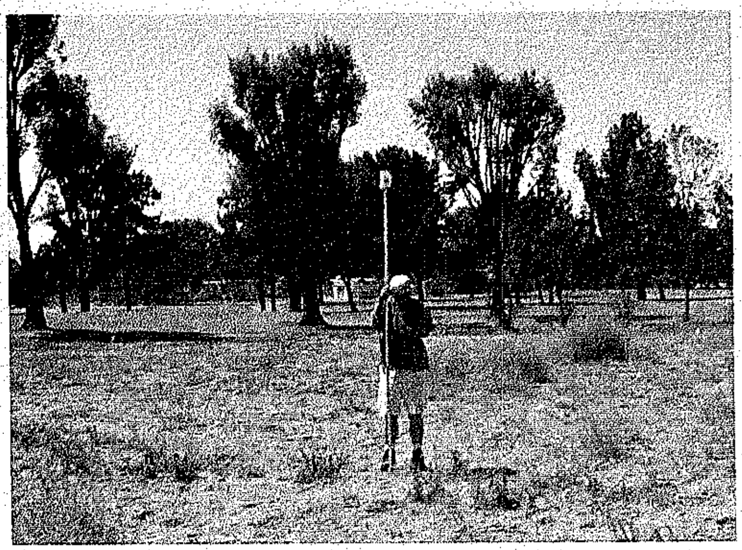
SITE PHOTOGRAPHS



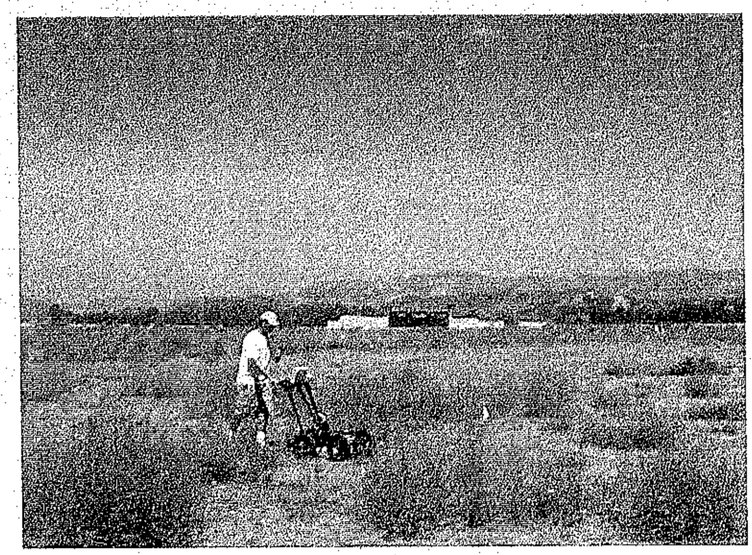
EM-31



EM-61



Magnetometer



GPR

FIGURE 3

Brief Description of the Geophysical Methods Applied - The EM-31 device energizes the ground by producing an alternating primary magnetic field with ac current in the transmitting coil. If conducting materials are within the area of influence of the primary field, ac eddy currents are induced to flow in the conductors. A receiving coil senses the secondary magnetic field produced by these eddy currents, and outputs the response to a meter in the form of ground conductivity values. The strength of the secondary field is a function of the conductivity of the object; say a pipe, tank or cluster of drums, its size, and its depth and position relative to the instrument's two coils. Conductive objects, to a depth of approximately 18 feet, are sensed. Also the device is somewhat focused, that is, it is more sensitive to conductors below (and above) the instrument, than to conductors off to the side.

The EM-61 instrument is a high resolution, time-domain device for detecting buried conductive objects. It consists of a powerful transmitter that generates a pulsed primary magnetic field when its coils are energized, which induces eddy currents in nearby conductive objects. The decay of the eddy currents, following the input pulse, is measured by the coils, which in turn serve as receiver coils. The decay rate is measured for two coils, mounted concentrically, one above the other. By making the measurements at a relatively long time interval (measured in milliseconds) after termination of the primary pulse, the response is nearly independent of the electrical conductivity of the ground. Thus, the instrument is a super-sensitive metal detector. Due to its unique coil arrangement, the response curve is a single well defined positive peak directly over a buried conductive object. This facilitates quick and accurate location of targets. Conductive objects, to a depth of approximately 11 feet can be detected.

The magnetometer, naturally, senses objects having magnetic properties. While some rocks exhibit magnetism, sediments and sedimentary rocks are generally non-magnetic. Igneous and metamorphic rocks are usually magnetic in varying degrees, but except in the extreme case of a magnetite ore, iron and steel cultural objects are much more magnetic than the most basic rocks. The earth's ambient magnetic field can be considered constant for small survey sites; Therefore, local, relatively high amplitude perturbations in the field may be expected to have their origin in iron and steel objects that are man's installations and discards. Above ground objects can be observed and, to some extent, qualitatively accounted for, leaving unseen objects, in the subsurface, expressed in the array of data. Ferrous objects to depths exceeding 30-40 feet can be detected with this instrumentation.

The GPR instrument beams energy into the ground from its transducer/antenna, in the form of electromagnetic waves. A portion of this energy is reflected back to the antenna at any boundary in the subsurface across which there is an electrical contrast. The recorder continuously makes a record of the reflected energy as the antenna is traversed across the ground surface. The greater the electrical contrast, the higher the amplitude of the returned energy. The EM wave travels at a velocity unique to the material properties of the ground being investigated, and when these velocities are known, or closely estimated from ground conductivity values and other information, two-way travel times can be converted to depth.

Penetration into the ground and resolution in the GPR images produced are a function of ground electrical conductivity and dielectric constant. Images tend to be graphic, even at considerable depth, in sandy soils, but penetration and resolution may be limited in drastically more conductive clayey moist ground.

Findings & Conclusions – All field data collected were downloaded in the field to insure quality control. The EM-31, EM-61, and Magnetics data are presented in contour map format superimposed on a site plan as Figures 4 through 6, respectively. The intent of this document is to demonstrate the procedure, and report the findings of the work

EM and magnetic data sets collected show good agreement. All three data sets appear to illustrate the effect of buried piping, primarily on the golf course portion of the grid. Subsurface debris suggestive of a landfill in the search area is not indicated from the data presented.

Radar penetration is a function of soil conductivity and dielectric constant. At this site local conditions were unfavorable due to the nature of the soil. This resulted in radar penetration down to only about 2 feet. Thereby limiting the effectiveness of GPR as a reconnaissance tool for landfill debris.

Subsurface Survey's professional personnel are trained and experienced and have completed thousands of projects since the company's inception in 1988. It is our policy to work diligently to bring this training and experience to bear to acquire quality data sets, which in turn, can provide clues useful in formulating our interpretations. Still, non-uniqueness of interpretations, methodological limitations, and non-target interferences are prevailing problems. Subsurface Surveys makes no guarantee either expressed or implied regarding the accuracy of the interpretations presented. And, in no event will Subsurface Surveys be liable for any direct, indirect, special, incidental, or consequential damages resulting from data sets, interpretations and opinions presented herewith.

All data generated on this project are in confidential file in this office, and are available for review by authorized persons at any time. The opportunity to participate in this investigation is very much appreciated. Please call, if there are questions.

Lawrence J. Favilla

Lawrence J. Favilla, GP969
Senior Geophysicist

EM-31 DATA

Contour Interval = 10 mmhos

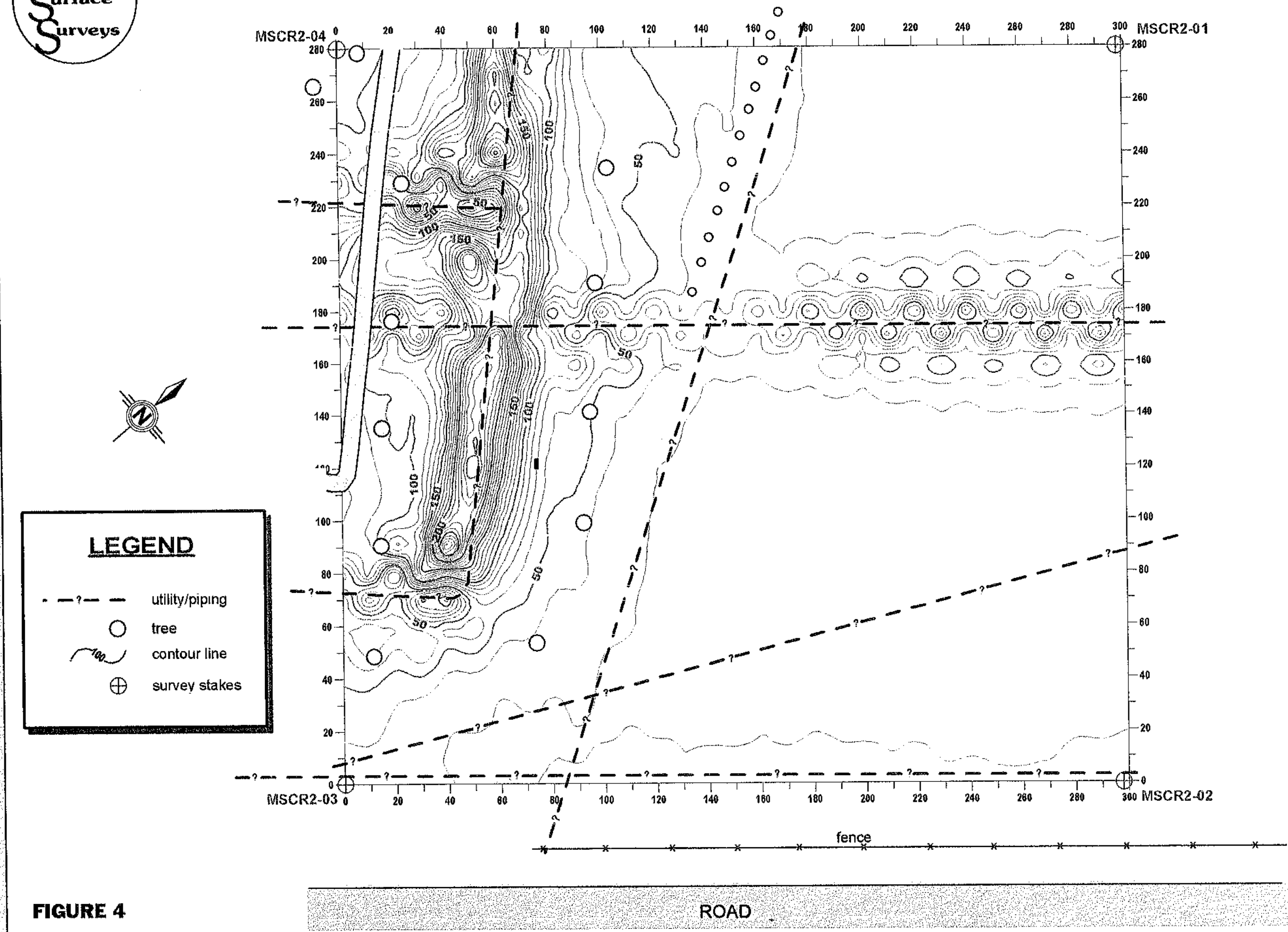


FIGURE 4

EM-61 DATA

Contour Interval = 50 mVolts

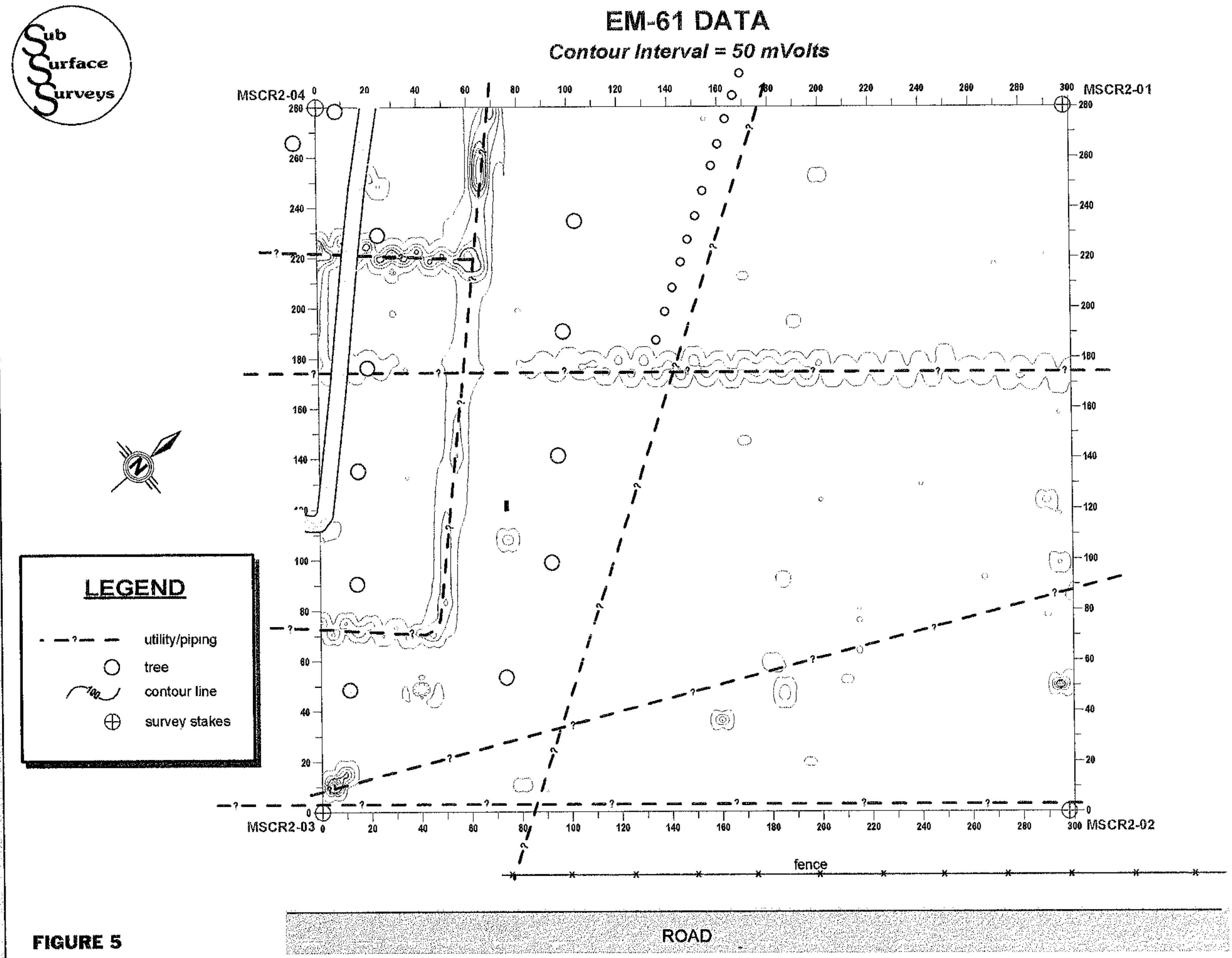


FIGURE 5

MAGNETICS DATA

Contour Interval = 50 gammas

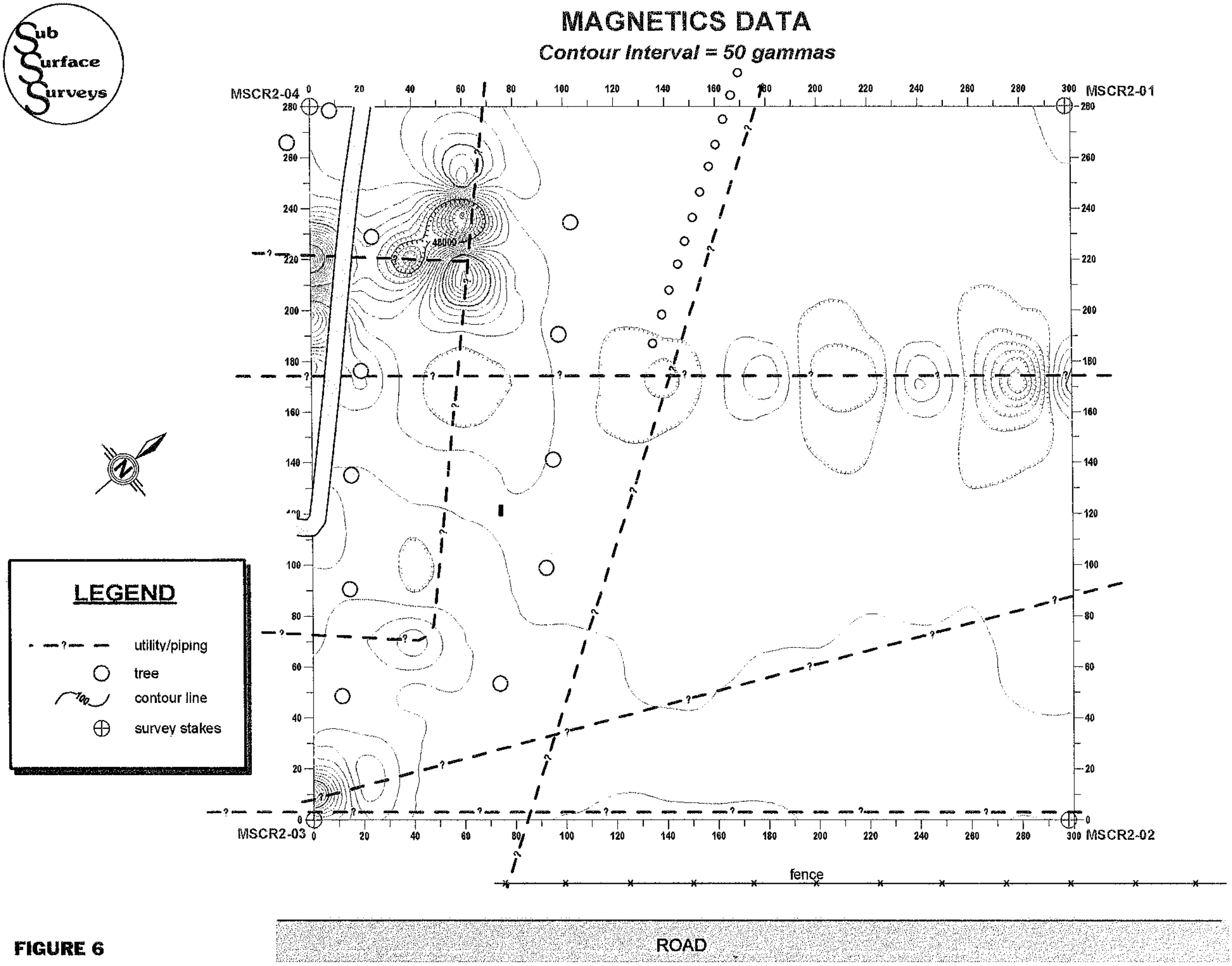


FIGURE 6

Appendix C
Analytical Results Phase I and Phase II Soil Sampling at APHO 46

Table C: Analytical Results for APHO 46 Phase I and Phase II Soil Sampling

Analyte	Units	APHO46-SS01 0.5 feet bgs LI001	APHO46-SS01 1 foot bgs LI007	APHO46-SS01 2 feet bgs LI008	APHO46-SS01 2 feet bgs (dup) LI009	APHO46-SS01 2.5 feet bgs LI059	APHO46-SS01 5 feet bgs LI060	APHO46-SS01 10 feet bgs LI061	APHO46-SS02 0.5 feet bgs LI002	APHO46-SS02 2 feet bgs LI010	APHO46-SS03 0.5 feet bgs LI003	APHO46-SS04 0.5 feet bgs LI004	APHO46-SS05 0.5 feet bgs LI005	APHO46-SS06 0.5 feet bgs LI006	APHO46-SS06 2 feet bgs LI011	APHO46-SS07 0.5 feet bgs LI055	APHO46-SS07 0.5 feet bgs (dup) LI058	APHO46-SS08 0.5 feet bgs LI056	APHO46-SS09 0.5 feet bgs LI057
VOCs																			
1,1,1,2-Tetrachloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,1,1-Trichloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,1,2-Trichloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,1,2-Trichlorotrifluoroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,1-Dichloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,1-Dichloroethene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,2,3-Trichloropropane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,2-Dichloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,2-Dichloropropane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
1,2-Dichlorotetrafluoroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
2-Hexanone	µg/kg	55 U	55 U	51 U	53 U	NA	NA	NA	55 U	56 U	56 U	53 U	52 U	53 U	55 U	NA	NA	NA	NA
4-Methyl-2-Pentanone (MIBK)	µg/kg	2 J	5.5 U	5.1 U	5.3 U	NA	NA	NA	3 J	5.6 U	2 J	1 J	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Acetone	µg/kg	110 UJ	110 UJ	100 UJ	110 UJ	NA	NA	NA	110 UJ	110 UJ	110 UJ	110 UJ	100 UJ	110 UJ	110 UJ	NA	NA	NA	NA
Benzene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Bromodichloromethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Bromoform	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Bromomethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Carbon Disulfide	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Carbon Tetrachloride	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Chlorobenzene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Chloroethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Chloroform	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Chloromethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
cis-1,2-Dichloroethene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
cis-1,3-Dichloropropene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Dibromochloromethane	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Dichlorodifluoromethane (Freon 12)	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Di-Isopropyl Ether	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Ethyl Tertiary Butyl Ether	µg/kg	3 J	3 J	2 J	5.3 U	NA	NA	NA	3 J	3 J	3 J	2 J	3 J	2 J	5.5 U	NA	NA	NA	NA
Ethylbenzene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Methyl Ethyl Ketone	µg/kg	110 U	110 U	100 U	110 U	NA	NA	NA	110 U	110 U	110 U	110 U	100 U	110 U	110 U	NA	NA	NA	NA
Methylene Chloride	µg/kg	5.5 U	6 UJ	5.1 U	5.3 U	NA	NA	NA	7 UJ	5.6 U	7 UJ	9 UJ	6 UJ	7 UJ	5.5 U	NA	NA	NA	NA
Methyl-Tert-Butyl Ether (MTBE)	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Styrene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Tertiary Amyl Methyl Ether	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Tertiary Butyl Alcohol	µg/kg	22 UJ	22 UJ	20 UJ	21 UJ	NA	NA	NA	22 UJ	22 UJ	22 UJ	21 UJ	21 UJ	21 UJ	22 UJ	NA	NA	NA	NA
Tetrachloroethene (PCE)	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Toluene	µg/kg	4 J	3 J	3 J	4 J	NA	NA	NA	4 J	3 J	4 J	3 J	3 J	3 J	5.5 U	NA	NA	NA	NA
trans-1,2-Dichloroethene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
trans-1,3-Dichloropropene	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Trichloroethene (TCE)	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Trichorofluoromethane	µg/kg	5.5 UJ	5.5 UJ	5.1 UJ	5.3 UJ	NA	NA	NA	5.5 UJ	5.6 UJ	5.6 UJ	5.3 UJ	5.2 UJ	5.3 UJ	5.5 U	NA	NA	NA	NA
Vinyl Chloride	µg/kg	5.5 U	5.5 U	5.1 U	5.3 U	NA	NA	NA	5.5 U	5.6 U	5.6 U	5.3 U	5.2 U	5.3 U	5.5 U	NA	NA	NA	NA
Xylenes, Total	µg/kg	16 U	16 U	15 U	16 U	NA	NA	NA	16 U	17 U	17 U	16 U	16 U	16 U	17 U	NA	NA	NA	NA
SVOCs																			
1,2,4-Trichlorobenzene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
1,2-Dichlorobenzene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
1,3-Dichlorobenzene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
1,4-Dichlorobenzene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	10,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,4,5-Trichlorophenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,4,6-Trichlorophenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,4-Dichlorophenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,4-Dimethylphenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,4-Dinitrophenol	µg/kg	51,000 UJ	51,000 UJ	52,000 UJ	52,000 UJ	NA	NA	NA	52,000 UJ	54,000 UJ	26,000 UJ	51,000 UJ	51,000 UJ	51,000 UJ	51,000 UJ	NA	NA	NA	NA
2,4-Dinitrotoluene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2,6-Dinitrotoluene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2-Chloronaphthalene	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2-Chlorophenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2-Methylphenol (o-cresol)	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
2-Nitroaniline	µg/kg	51,000 U	51,000 U	52,000 U	52,000 U	NA	NA	NA	52,000 U	54,000 U	26,000 U	51,000 U	51,000 U	51,000 U	51,000 U	NA	NA	NA	NA
2-Nitrophenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
3,3'-Dichlorobenzidine	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
3/4-Methylphenol (m/p-cresol)	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
3-Nitroaniline	µg/kg	51,000 U	51,000 U	52,000 U	52,000 U	NA	NA	NA	52,000 U	54,000 U	26,000 U	51,000 U	51,000 U	51,000 U	51,000 U	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	µg/kg	51,000 U	51,000 U	52,000 U	52,000 U	NA	NA	NA	52,000 U	54,000 U	26,000 U	51,000 U	51,000 U	51,000 U	51,000 U	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
4-Chloro-3-Methylphenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
4-Chloroaniline	µg/kg	20000 U	20000 U	21000 U	21000 U	NA	NA	NA	21000 U	22000 U	10,000 U	20,000 U	20,000 U	20,000 U	21000 U	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
4-Nitroaniline	µg/kg	51,000 U	51,000 U	52,000 U	52,000 U	NA	NA	NA	52,000 U	54,000 U	26,000 U	51,000 U	51,000 U	51,000 U	51,000 U	NA	NA	NA	NA
4-Nitrophenol	µg/kg	51,000 U	51,000 U	52,000 U	52,000 U	NA	NA	NA	52,000 U	54,000 U	26,000 U	51,000 U	51,000 U	51,000 U	51,000 U	NA	NA	NA	NA
Benzyl Butyl Phthalate	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
Bis(2-Chloroethoxy) Methane	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
Bis(2-Chloroethyl) Ether	µg/kg	3,300 U	3,300 U	3,400 U	3,400 U	NA	NA	NA	3,400 U	3,500 U	1,700 U	3,300 U	3,300 U	3,300 U	3,400 U	NA	NA	NA	NA
Bis(2-ethylhexyl) Phthalate	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
Carbazole	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
Dibenzofuran	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA

Table C: Analytical Results for APHO 46 Phase I and Phase II Soil Sampling

Analyte	Units	APHO46-SS01 0 5 feet bgs LI001	APHO46-SS01 1 foot bgs LI007	APHO46-SS01 2 feet bgs LI008	APHO46-SS01 2 feet bgs (dup) LI009	APHO46-SS01 2 5 feet bgs LI059	APHO46-SS01 5 feet bgs LI060	APHO46-SS01 10 feet bgs LI061	APHO46-SS02 0 5 feet bgs LI002	APHO46-SS02 2 feet bgs LI010	APHO46-SS03 0 5 feet bgs LI003	APHO46-SS04 0 5 feet bgs LI004	APHO46-SS05 0 5 feet bgs LI005	APHO46-SS06 0 5 feet bgs LI006	APHO46-SS06 2 feet bgs LI011	APHO46-SS07 0 5 feet bgs LI055	APHO46-SS07 0 5 feet bgs (dup) LI058	APHO46-SS08 0 5 feet bgs LI056	APHO46-SS09 0 5 feet bgs LI057
SVOCs, Continued																			
Diethyl Phthalate	µg/kg	10 000 U	10 000 U	10,000 U	10,000 U	NA	NA	NA	10 000 U	11 000 U	5,200 U	10 000 U	10,000 U	10 000 U	10,000 U	NA	NA	NA	NA
Dimethyl Phthalate	µg/kg	10,000 U	10,000 U	10 000 U	10 000 U	NA	NA	NA	10,000 U	11,000 U	5 200 U	10,000 U	10 000 U	10,000 U	10 000 U	NA	NA	NA	NA
Di-n-butyl Phthalate	µg/kg	10 000 U	10 000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11 000 U	5,200 U	10 000 U	10,000 U	10,000 U	10 000 U	NA	NA	NA	NA
Di-n-octyl Phthalate	µg/kg	10 000 U	10,000 U	10,000 UJ	10 000 U	NA	NA	NA	10 000 U	11,000 U	5 200 U	10,000 U	10,000 UJ	10 000 U	10,000 U	NA	NA	NA	NA
Hexachlorobenzene	µg/kg	10,000 U	10 000 U	10 000 U	10,000 U	NA	NA	NA	10,000 U	11 000 U	5 200 U	10,000 U	10 000 U	10,000 U	10 000 U	NA	NA	NA	NA
Hexachlorobutadiene	µg/kg	10 000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10 000 U	11 000 U	5,200 U	10 000 U	10,000 U	10 000 U	10,000 U	NA	NA	NA	NA
Hexachlorocyclopentadiene	µg/kg	51,000 U	51,000 U	52 000 U	52 000 U	NA	NA	NA	52 000 U	54,000 U	26,000 U	51,000 U	51,000 UJ	51,000 U	51 000 U	NA	NA	NA	NA
Hexachloroethane	µg/kg	10 000 U	10 000 U	10 000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10 000 U	10 000 U	10,000 U	10 000 U	NA	NA	NA	NA
Isophorone	µg/kg	10 000 U	10,000 U	10,000 U	10 000 U	NA	NA	NA	10 000 U	11,000 U	5 200 U	10,000 U	10,000 U	10 000 U	10,000 U	NA	NA	NA	NA
Nitrobenzene	µg/kg	10,000 U	10 000 U	10 000 U	10,000 U	NA	NA	NA	10,000 U	11 000 U	5,200 U	10 000 U	10 000 U	10,000 U	10,000 U	NA	NA	NA	NA
n-nitrosodi-n-propylamine	µg/kg	530 U	530 U	540 U	540 U	NA	NA	NA	540 U	560 U	270 U	530 U	530 U	530 U	530 U	NA	NA	NA	NA
n-nitrosodiphenylamine	µg/kg	51,000 U	51,000 U	52 000 U	52 000 U	NA	NA	NA	52,000 U	54 000 U	26 000 U	51,000 U	51 000 U	51,000 U	51 000 U	NA	NA	NA	NA
Pentachlorophenol	µg/kg	35 000 U	35 000 U	35 000 U	35,000 U	NA	NA	NA	35 000 U	37 000 U	18,000 U	35 000 U	35,000 U	35,000 U	35 000 U	NA	NA	NA	NA
Phenol	µg/kg	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	10,000 U	11,000 U	5,200 U	10,000 U	10,000 U	10,000 U	10,000 U	NA	NA	NA	NA
PAHs																			
Acenaphthene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Acenaphthylene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Anthracene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Benzo(a)anthracene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Benzo(a)pyrene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Benzo(b)fluoranthene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Benzo(g,h,i)perylene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Benzo(k)fluornthene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Chrysene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Dibenz(a,h)anthracene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Fluoranthene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Fluorene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
2-Methylnaphthalene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Naphthalene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Phenanthrene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
Pyrene	µg/kg	510 U	510 U	520 U	520 U	NA	NA	NA	520 U	540 U	260 U	510 U	510 U	510 U	510 U	NA	NA	NA	NA
PCBs																			
Aroclor 1016	µg/kg	34 U	34 U	34 U	34 U	NA	NA	NA	34 U	36 U	34 U	34 U	34 U	34 U	34 U	NA	NA	NA	NA
Aroclor 1221	µg/kg	67 U	67 U	69 U	68 U	NA	NA	NA	68 U	71 U	68 U	67 U	67 U	67 U	68 U	NA	NA	NA	NA
PCBs, Continued																			
Aroclor 1232	µg/kg	34 U	34 U	34 U	34 U	NA	NA	NA	34 U	36 U	34 U	34 U	34 U	34 U	34 U	NA	NA	NA	NA
Aroclor 1242	µg/kg	34 U	34 U	34 U	34 U	NA	NA	NA	34 U	36 U	34 U	34 U	34 U	34 U	34 U	NA	NA	NA	NA
Aroclor 1248	µg/kg	34 U	34 U	34 U	34 U	NA	NA	NA	34 U	36 U	34 U	34 U	34 U	34 U	34 U	NA	NA	NA	NA
Aroclor 1254	µg/kg	34 U	34 U	34 U	34 U	NA	NA	NA	34 U	36 U	34 U	34 U	34 U	34 U	34 U	NA	NA	NA	NA
Aroclor 1260	µg/kg	37	19 J	19 J	28 J	NA	NA	NA	22 J	17 J	8 J	11 J	17 J	15 J	10 J	NA	NA	NA	NA
Organochlorine Pesticides																			
4,4'-DDD	µg/kg	13	27	20	27	NA	NA	NA	11	15	6	11	23	8 3	15	NA	NA	NA	NA
4 4'-DDE	µg/kg	11	8 3	11	16	NA	NA	NA	16	9.6	23	20	7 3	7.7	6	NA	NA	NA	NA
4,4'-DDT	µg/kg	39	47	40	64	NA	NA	NA	41	27	18	23	41	21	28	NA	NA	NA	NA
Aldrin	µg/kg	0 7 U	1 7 U	1 8 U	1 8 U	NA	NA	NA	1.8 U	1 8 U	1 8 U	1.7 U	1 7 U	1 7 U	1.7 U	NA	NA	NA	NA
Alpha BHC	µg/kg	0.7 U	1.7 U	1.8 U	1.8 U	NA	NA	NA	1 8 U	1 8 U	1.8 U	1 7 U	1 7 U	1.7 U	1 7 U	NA	NA	NA	NA
Alpha-Chlordane	µg/kg	0.7 J	2	0 7 J	1 J	NA	NA	NA	1 0 U	0 4 J	1 0 U	0 6 J	1	1 0 U	0 5 J	NA	NA	NA	NA
Beta BHC	µg/kg	0 7 U	1 7 U	1 8 U	1.8 U	NA	NA	NA	1.8 U	1 8 U	1 8 U	1.7 U	1 7 U	1.7 U	1.7 U	NA	NA	NA	NA
Delta BHC	µg/kg	0 7 U	1.7 U	1.8 U	1 8 U	NA	NA	NA	1 8 U	1 8 U	1.8 U	1 7 U	1 7 U	1.7 U	1 7 U	NA	NA	NA	NA
Dieldrin	µg/kg	3 1 U	3 1 U	3.1 U	3 1 U	NA	NA	NA	3 1 U	3.2 U	3 1 U	3 1 U	3.1 U	3 1 U	3.1 U	NA	NA	NA	NA
Endosulfan I	µg/kg	3 1 U	3 1 U	3 1 U	3.1 U	NA	NA	NA	3.1 U	3.2 U	3 1 U	3.1 U	3 1 U	3 1 U	3.1 U	NA	NA	NA	NA
Endosulfan II	µg/kg	3.1 U	3.1 U	3.1 U	3 1 U	NA	NA	NA	3 1 U	3 2 U	3.1 U	3 1 U	3 1 U	3 1 U	3 1 U	NA	NA	NA	NA
Endosulfan Sulfate	µg/kg	5 1 U	5 1 U	5 2 U	5 2 U	NA	NA	NA	5 2 U	5.4 U	5 2 U	5 1 U	5.1 U	5 1 U	5.1 U	NA	NA	NA	NA
Endrin	µg/kg	3 1 U	3.1 U	3.1 U	3.1 U	NA	NA	NA	3 1 U	3 2 U	3 1 U	3.1 U	3 1 U	3.1 U	3 1 U	NA	NA	NA	NA
Endrin Aldehyde	µg/kg	3.1 U	3.1 U	3 1 U	3 1 U	NA	NA	NA	3 1 U	3 2 U	3.1 U	3 1 U	3.1 U	3 1 U	3 1 U	NA	NA	NA	NA
Endrin Ketone	µg/kg	3.1 U	3 1 U	3 1 U	3 1 U	NA	NA	NA	3.1 U	3.2 U	3 1 U	3.1 U	3.1 U	3 1 U	3.1 U	NA	NA	NA	NA
Gamma BHC (Lindane)	µg/kg	0 7 U	1.7 U	1.8 U	1.8 U	NA	NA	NA	1 8 U	1 8 U	1 8 U	1 7 U	1 7 U	1.7 U	1 7 U	NA	NA	NA	NA
Gamma-Chlordane	µg/kg	2	2	2	2	NA	NA	NA	2	2	0 6 J	1	1.0 U	1	0 9 J	NA	NA	NA	NA
Heptachlor	µg/kg	1 7 U	1 7 U	1 7 U	1.8 U	NA	NA	NA	1.8 U	1 8 U	1 8 U	1.7 U	1 7 U	1.7 U	1.7 U	NA	NA	NA	NA
Heptachlor Epoxide	µg/kg	1.7 U	1.7 U	1.7 U	1.8 U	NA	NA	NA	1.8 U	1 8 U	1.8 U	1.7 U	1.7 U	1.7 U	1.7 U	NA	NA	NA	NA
Methoxychlor	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
Toxaphene	µg/kg	100 U	100 U	100 U	100 U	NA	NA	NA	100 U	110 U	100 U	100 U	100 U	100 U	100 U	NA	NA	NA	NA
Chlorinated Herbicides																			
2,4,5-T	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
2 4 5-TP (Silvex)	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
2,4-D	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
2,4-DB	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
Dalapon (Dichloroacetic Acid)	µg/kg	20 U	20 U	21 U	21 U	NA	NA	NA	21 U	22 U	21 U	20 U	20 U	20 U	21 U	NA	NA	NA	NA
Dicamba	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
Dichloroprop	µg/kg	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	11 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA
Dinoseb (DNBP)	µg/kg	20 U	20 U	21 U	21 U	NA	NA	NA	21 U	22 U	21 U	20 U	20 U	20 U	21 U	NA	NA	NA	NA
MCPA	µg/kg	2 000 U	2 000 U	2 100 U	2 100 U	NA	NA	NA	2 100 U	2,200 U	2 100 U	2,000 U	2,000 U	2 000 U	2,100 U	NA	NA	NA	NA
MCPP	µg/kg	2,000 U	2,000 U	2,100 U	2,100 U	NA	NA	NA	2,100 U	2,200 U	2,100 U	2,000 U	2,000 U	2,000 U	2,100 U	NA	NA	NA	NA
Petroleum Hydrocarbons																			
Motor Oils	mg/kg	510	1,200	820	900	NA	NA	NA	580	1,200	130	380	490	300	330	NA	NA	NA	NA
PHC as Diesel Fuel	mg/kg	61 J	120	67 J	68 J	NA	NA	NA	39 J	70 J	5 J	19 J	22 J	9 J	13 J	NA	NA	NA	NA
PHC as Gasoline	mg/kg	0.2 J	0.1 J	0.2 J	0.2 J	NA	NA	NA	0.5 J	0.3 J	0.2 J	0.2 J	0.3 J	0.1 J	0.2 J	NA	NA	NA	NA

Table C: Analytical Results for APHO 46 Phase I and Phase II Soil Sampling

Analyte	Units	APHO46-SS01 0 5 feet bgs LI001	APHO46-SS01 1 foot bgs LI007	APHO46-SS01 2 feet bgs LI008	APHO46-SS01 2 feet bgs (dup) LI009	APHO46-SS01 2 5 feet bgs LI059	APHO46-SS01 5 feet bgs LI060	APHO46-SS01 10 feet bgs LI061	APHO46-SS02 0 5 feet bgs LI002	APHO46-SS02 2 feet bgs LI010	APHO46-SS03 0 5 feet bgs LI003	APHO46-SS04 0 5 feet bgs LI004	APHO46-SS05 0 5 feet bgs LI005	APHO46-SS06 0 5 feet bgs LI006	APHO46-SS06 2 feet bgs LI011	APHO46-SS07 0 5 feet bgs LI055	APHO46-SS07 0 5 feet bgs (dup) LI058	APHO46-SS08 0 5 feet bgs LI056	APHO46-SS09 0 5 feet bgs LI057
Metals																			
Aluminum	mg/kg	7,960	8,240	9,290	10,600	NA	NA	NA	10,900	10,000	11,900	9,750	5,570	8,950	8,870	NA	NA	NA	NA
Antimony	mg/kg	0.81 UJ	2 4	0 46 UJ	0 66 UJ	NA	NA	NA	0.82 UJ	6.5 U	0.29 UJ	1.3 UJ	0.43 UJ	1 1 UJ	0.64 UJ	NA	NA	NA	NA
Arsenic	mg/kg	3.4	4.5	3.9	3.7	NA	NA	NA	3.9	3.9	3.9	4	2 4	3.5	3.3	NA	NA	NA	NA
Barium	mg/kg	86.1	113	100	106	NA	NA	NA	117	94.8	117	113	62	108	97.9	NA	NA	NA	NA
Beryllium	mg/kg	0 20 U	0 20 U	0.21 U	0.41 U	NA	NA	NA	0 21 U	0.43 U	0.21 U	0 20 U	0.20 U	0 20 U	0.41 U	NA	NA	NA	NA
Cadmium	mg/kg	1	1.6	0.94	1.1	NA	NA	NA	1.2	0.75	1.4	1.7	0.6	1.3	0.74	NA	NA	NA	NA
Calcium	mg/kg	5,130	9 400	9 970	11,700	NA	NA	NA	5,650	8 090	4,750	6,320	3,900	5,720	6,800	NA	NA	NA	NA
Chromium	mg/kg	8 7	11.5	11.1	10.9	NA	NA	NA	12.7	11.4	12.2	10.3	6 6	10.8	10	NA	NA	NA	NA
Cobalt	mg/kg	4.4	4.9	5.4	5.7	NA	NA	NA	5.5	5.6	5.3	5 4	3.3	5.7	5	NA	NA	NA	NA
Copper	mg/kg	14.7	36.7	19.6	34.5	NA	NA	NA	24.6	16.1	12.7	31.9	10.9	32.1	16.1	NA	NA	NA	NA
Iron	mg/kg	10,600	14,600	12,600	14,300	NA	NA	NA	14,900	13,400	15,300	14,300	7 720	16,400	11,900	NA	NA	NA	NA
Lead	mg/kg	23.7	73.2	25.1	28.3	NA	NA	NA	22.6	17.8	12.3	25	19.5	44.6	17.1	NA	NA	NA	NA
Magnesium	mg/kg	3,680	3,990	4,310	4,940	NA	NA	NA	4,670	4,530	4,870	4,810	2,710	4,640	4,360	NA	NA	NA	NA
Manganese	mg/kg	180	221	207	240	NA	NA	NA	226	219	234	247	137	245	208	NA	NA	NA	NA
Mercury	mg/kg	0 097	1 5	0.11	0.18	NA	NA	NA	0 091	0.08	0.044	0.098	0.14	0.12	0.075	NA	NA	NA	NA
Nickel	mg/kg	8	11.3	10.2	10	NA	NA	NA	11.2	13.6	10.4	10.3	7.4	10.5	9.7	NA	NA	NA	NA
Potassium	mg/kg	2,320	2,140	2,340	2,350	NA	NA	NA	3,190	2,370	3,700	2,640	1,620	2,790	2,200	NA	NA	NA	NA
Selenium	mg/kg	0.31 U	0 31 U	0.13 UJ	0.62 U	NA	NA	NA	0.31 U	0.65 U	0.15 UJ	0.19 UJ	0.20 UJ	0.20 UJ	0 62 U	NA	NA	NA	NA
Silver	mg/kg	0.33 UJ	1.1	0 078 UJ	0.29 UJ	NA	NA	NA	0.26 UJ	1.1 U	0 053 UJ	0.39 J	0.51 U	0.8	1.0 U	NA	NA	NA	NA
Sodium	mg/kg	100 U	100 U	100 U	210 U	NA	NA	NA	100 U	220 U	100 U	100 U	100 U	100 U	210 U	NA	NA	NA	NA
Thallium	mg/kg	0.41 U	0.41 U	0.42 U	0.83 U	NA	NA	NA	0.41 U	0.86 U	0.41 U	0.41 U	0 41 U	0.41 U	0.82 U	NA	NA	NA	NA
Vanadium	mg/kg	23.5	27.4	29 7	33.6	NA	NA	NA	30.9	32.2	31.5	29 1	18	26 9	26.7	NA	NA	NA	NA
Zinc	mg/kg	69.6	122	74.2	91.1	NA	NA	NA	75.4	58.6	59.4	82.4	45.3	112	62.4	NA	NA	NA	NA
Dioxins																			
2,3,7,8-TCDD	pg/g	0 297	0 547	0 311	0.356	0.224	0 293	0.294 U	0.159 U	0 286	0.202	0 297	0.251	0.279	0.216 U	0 279 U	0 292	0.195	0.111 U
1 2 3 4 7 8-PeCDD	pg/g	0.591	1 99	0.855	1.11	0.524 UJ	0.841	0.294 U	0.735	0.686	0.398	0.647	0.876	1.14	0.681	1.15	0.996	0.803	0.312 UJ
1,2,3,4,7,8-HxCDD	pg/g	0.974	2.63	1.05	1 23	0.504 UJ	1.18	0.306 U	1.21	0.867	0 545	0.876	1.27	1.44	0.828	1.19	1.03	0.338 UJ	0.179 UJ
1 2 3 6 7 8-HxCDD	pg/g	2.09	4.29	2.02	2.44	1.44	2.13	0.635	3	1 55	1.46	1.8	2.27	2.82	1.65	2 72	2.47	2.27	1 33
1 2 3 7 8 9-HxCDD	pg/g	1.8	3.3	1.63	1.99	1.26	1.74	0.546 UJ	2.39	1.28	1.42	1.49	2.02	2.3	1.47	2.27	2.13	2.09	1.63
1,2,3,4,6,7,8-HpCDD	pg/g	21.8	37.1	21	26.6	13.4	15.9	20.4	42.8	16.9	19	14.8	21	28.3	13	33	34.9	20.3	12.9
OCDD	pg/g	129	186	120	168	87.4	69	182	304	109	253	84.5	120	161	64.4	194	209	157	121
2,3,7,8-TDCF	pg/g	1.38	3.17	1.53	1 68	0.945	1.64	0.174 UJ	1.29	1.25	0 727	1.31	1 29	1.79	1 16	2.29	1.95	0.509	0.43
1 2,3 7 8-PeCDF	pg/g	1.49	4 27	1 79	2.18	0.748	2.01	0.294 U	2.13	1 33	0.705	1 73	1.61	2.47	1.45	2.4	2.13	0 513 UJ	0.315 UJ
2 3 4 7 8-PeCDF	pg/g	3.36	7.99	3.43	3.49	1 51	3.54	0.158 UJ	3.7	2.49	1.33	3.15	2.61	5.05	2.55	4.41	3 79	1.53	0.481 UJ
1,2,3,4,7,8-HxCDF	pg/g	3 33	9.35	3.6	4 69	1.41	4.77	0 320 U	5.99	3.04	1.23	3.37	3.72	5.53	3.07	5.26	4.35	1.46	0.337 UJ
1 2 3 6 7 8-HxCDF	pg/g	2 62	7.08	2.94	3.48	1.17	3.49	0.294 U	4.78	2.37	1.04	2.71	2.8	4.36	2.47	4.3	3.62	0.838	0 362 UJ
2,3,4,6,7,8-HxCDF	pg/g	4.14	11.4	4.41	5 02	1.65	5.49	0.312 U	7.1	3.35	1.54	3.98	4 56	6.8	3.72	6.05	4 82	0.801	0.438 UJ
1,2 3,7 8 9-HxCDF	pg/g	1.04	1.99	1.01	1.34	0.591 UJ	1.02	0.387 U	2.48	0 654	0.776	1.2	1.08	1.64	0.754	1.24	0.85	1 11	0.849
1 2 3 4 6 7 8 -HpCDF	pg/g	14.4	34.5	14.2	17.9	7.12	21.7	0.849	30.8	11.7	6.14	14.7	15.7	27.1	12.7	24.5	20.4	9.53	4.76
1,2,3,4,7,8,9-HpCDF	pg/g	1.1	2.47	1.12	1.39	0.805	1.25	0.294 U	4.85	1.03	0 423	1.15	1.26	1.89	1 01	1.34	1.06	0.54	0.267
OCDF	pg/g	12.2	24 3	12.3	13.2	6 25	9 36	2.31	42.1	11.5	11	10.9	13.3	21.5	8.15	14 8	14 5	14	16.7
Total TCDDs	pg/g	2.73	15.5	3.98	2 18	1 26	2.06	0.282	3 48	2.69	1 08	4.02	1 95	5.45	2 24	4.13	6.14	12 6	0.796
Total PeCDDs	pg/g	9.76	35 7	11 2	7.18	5.24	12 3	0 550 U	7.77	7.32	5.07	8.41	9.07	15 4	6.06	16 3	13.1	14 6	3.07
Total HxCDDs	pg/g	28 8	71.7	29.9	36 8	13 9	28 9	4.88	36 5	22.8	17 1	23 3	31	39 7	23 9	37.4	32 7	16.6	8.2
Total HpCDDs	pg/g	49.9	92 8	47 8	73 4	27.2	33.4	37	88.3	38 1	43 4	35 9	44 3	60.2	27.7	74.9	77 9	37 8	24.7
Total TCDFs	pg/g	18 4	67 5	25.8	16.3	12 1	24.4	0.419	18 9	18 9	14.5	20 2	10.7	33 1	14	40	36.1	10.6	6 16
Total PeCDFs	pg/g	35.6	94.2	39 1	40 2	18 1	43	0.985	43 9	30.3	14 1	32.6	28 7	51.8	26 4	50	38 1	11.3	7.58
Total HxCDFs	pg/g	32.7	89	36 4	40 9	16.4	39.8	0 896 UJ	58.2	27 9	13 1	31 6	31 3	50 2	27 4	49 9	42 2	15 6	8.07
Total HpCDFs	pg/g	23.6	45.3	21.5	27.5	11.9	29	2.72	53.9	16.3	11.2	21.8	24.3	39.7	18.6	35.8	29.8	16.4	11.7
2,3,7,8-TCDD TEQ	pg/g	4.77E+00	1.18E+01	5.17E+00	5.98E+00	2.34	5.55	0.75	6.41E+00	4.03E+00	2.46E+00	4.60E+00	4.81E+00	7.33E+00	3.92E+00	6.76	6.00	3.02	1.02

Notes:

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
NA = not analyzed
pg/g = picograms per gram
TEQ = toxicity equvalency
U = The analyte was not detected at the threshold indicated
J = The level stated is an estimated value
UJ = The analyte was not detected; however the level stated is an estimated value
HpCDD = heptachlorodibenzodioxin
HpCDF = heptachlorodibenzofuran
HxCDD = hexachlorodibenzodioxin
HxCDF = hexachlorodibenzofuran
OCDD = octachlorodibenzodioxin
OCDF = octachlorodibenzofuran
PeCDD = pentachlorodibenzodioxin
PeCDF = pentachlorodibenzofuran
TCDD = tetrachlorodibenzodioxin
TCDF = tetrachlorodibenzofuran